IMPERIAL MYCOLOGICAL INSTITUTE

REVIEW
OF
APPLIED MYCOLOGY

VOL. XIX MAY 1940

HYNES (H. J.) & WILSON (R. D.). **Fungicidal treatment of Pea seed. Beneficial results from dusting.**—*Agric. Gaz. N.S.W.*, l, 12, pp. 657–659, 1 fig., 1939.

To investigate the effect of fungicidal dusting upon the faulty germination of imported pea seed (associated with cracking of the seed coat due to injury and infection by weak parasites), tests were carried out in 1936 in New South Wales in which imported pea seeds were shaken up with various dusts in a container for two minutes, allowed to remain in the packet for 24 hours, and then sown in an experimental plot. After three weeks the seed treated with agrosan 13536 (½ oz. per bush.), cuprous oxide (2½ oz.), and copper carbonate (2 oz.) showed, respectively, 48, 50, and 58 per cent. germination, as against 36 per cent. for the untreated control [cf. *R.A.M.*, xviii, p. 495]. In 1937–8, seed similarly treated with cuprous oxide (2½ oz.), copper carbonate (2 oz.), agrosan 13536 (½ oz.), agrosan 14836 (2 oz.), agrosan RD 7312 (2 oz.), ceresan 3657 (½ oz.), and ceresan 3779 (½ oz.) gave, respectively, 46, 53, 51, 45, 55, 45, and 58 per cent. germination, as compared with 25 per cent. in the control. When excess dust was used (in 1939) ceresan U.T. 1875a gave 54 per cent. germination, as against 23 per cent. for the control, while in another test cuprous oxide (samples *a*, *b*, and *c*), ceresan U.T. 1875a, and agrosan 14836 gave, respectively, 37, 53, 49, 37, and 23 per cent. germination, as against 21 per cent. for the control. In a further test, cuprous oxide (samples *b* and *d*), copper carbonate, copper oxychloride, and ceresan U.T. 1875a gave, respectively, 84, 82, 88, 87, and 85 per cent. germination, as against 73 per cent. for the control. When used in excess, agrosan 14836 and one sample of cuprous oxide had a rather stunting effect on the plants, while agrosan 13536 caused stunting and reduction of germination.

It is concluded that although no increase in stand may follow the dusting of good seed, treatment is well worth the trifling cost involved, as a precaution against bad stands. The treatments recommended are (in descending order of preference): copper carbonate (2 oz.), cuprous oxide (sample *b*, 2½ oz.), and ceresan U.T. 1875b (1½ oz.).

LAMBERT (E. B.). **Notes on the establishment and maintenance of truffières (Truffle orchards).**—9 pp., U.S. Dep. Agric., Bur. Pl. Ind., 1939. [Mimeographed.]

Based mainly on recent French contributions to the literature of the subject, these brief, practical notes on the cultivation of the Périgord

truffle (*Tuber melanosporum*) [*R.A.M.*, vii, p. 423; xiv, pp. 420, 783] deal with such points as soil inoculation, choice of site, soil texture, reaction, and drainage, selection of truffle-bearing trees (of which the best in colder localities are *Quercus pedunculata* and *Q. sessiliflora*, and in warmer ones *Q. ilex* and *Q. coccifera*), seedling propagation, the setting out of the young trees, irrigation, fertilization, pruning, and the harvesting of the crop.

THOMAS (K. M.). **Detailed administration Report of the Government Mycologist, Madras, for the year 1938–39.**—30 pp., 2 graphs, 1939.

This report on plant disease work in Madras during 1938–9 [*R.A.M.*, xviii, p. 88] contains the following items of interest. In field studies with 36 strains of rice the departmental strains Co 2, Co 7, Co 9, Co 10, Adt 3, Mtu 5, and Mtu 9 all proved susceptible to *Piricularia oryzae*; Adt 6 was the most resistant and Co 4 and Co 11, hitherto regarded as resistant, showed 12 and 17 per cent. infection, respectively. In monthly sowings from September to December, the later plantings suffered less than the earlier ones. When diseased material was stored in pulverized rice soil, pulverized farmyard manure, and dry blotting paper, the fungus remained viable for 13 months.

Helminthosporium tetramera [*Curvularia spicifera*: ibid., xvi, p. 735] obtained from rice failed to produce infection when inoculated on to rice leaves, stems, and ear heads, though in similar tests *H. oryzae* [*Ophiobolus miyabeanus*] gave positive results in 48 hours.

When barley, oats, wheat, cholam [sorghum], cumbu [*Pennisetum typhoides*], ragi [*Eleusine coracana*], tenai, and maize seedlings were cross-inoculated with *C. spicifera*, *H. nodulosum* [ibid., xviii, p. 185], and *H. sativum*, *C. spicifera* failed to produce any infection, *H. sativum* and *H. nodulosum* infected barley, oats, wheat, *P. typhoides*, *E. coracana*, tenai, and maize, and sorghum was not infected by any of the three species. When cross-inoculations were made on the leaves and ear heads, *C. spicifera* failed to infect *E. coracana* and wheat, while *H. nodulosum* and *H. sativum* infected both these hosts. In the course of a cultural study of these fungi it was found that the optimum growth temperature for all was near 30° C. and that although the growth of *O. miyabeanus* and *H. sativum* was completely checked at 36·5° *H. nodulosum* and *C. spicifera* were able to grow at that temperature.

Among the results of a detailed comparative cultural and pathogenicity study of *Phytophthora arecae* from areca palm with strains of *P.* from Palmyra palm [*Borassus flabellifer*], citrus, tobacco, and betel vine [*Piper betle*] it was found that *Trichoderma lignorum* was antagonistic to all these fungi. The optimum growth temperature of the *Phytophthora* associated with betel vine [*Piper betle*] wilt [ibid., xviii, p. 437] was about 30°; no growth occurred at 15° or 35°.

Germinating horse gram [*Dolichos biflorus*] seeds transferred to soil inoculated with *Macrophomina phaseoli* showed only a small percentage of infection, but when germinating seedlings were inoculated in the radicle and transferred to soil, 50 to 66 per cent. infection resulted, as against 17 to 33 per cent. by other methods. The length of the root system in healthy and diseased seedlings was, respectively, 8·7 to 13·7 and 1·5 to 2·85 in. *M. phaseoli* grew best at about 37°, growth rate

increasing as the temperature rose from 8° to 37°. The pathogenicity of *M. phaseoli* was completely checked in the presence of *T. lignorum*, and its growth retarded by filtrates from liquid cultures of the latter.

The best growth of the fungus causing *E. coracana* blast (*Piricularia* sp.) [cf. ibid., xvii, pp. 295, 454] in culture took place between P_H 5 and 6·4; during growth this value tended to shift to P_H 6. The optimum growth temperature was about 29·5°, and the thermal death point of the conidia (5 minutes' exposure) between 48° and 49°.

Sucrose was the best source of carbon, and asparagin, peptone, and potassium nitrate were good sources of nitrogen for *Colletotrichum falcatum* [ibid., xviii, p. 625], which made poor growth when supplied with starch or ammoniacal nitrogen and was unable to utilize cellulose or potassium nitrite. Spore size was affected by the nitrogen source. With different carbon/nitrogen ratios, the greatest dry weight of mycelium was obtained at 5/1, growth gradually diminishing as the proportion of carbon was reduced. The optimum, minimum, and maximum temperatures for the original isolation and a lighter-coloured saltant were, respectively, about 32·5°, 10°, and 37·5°.

Cross-inoculations with *C. indicum* [ibid., xiii, p. 683] from diseased cotton bolls on plants belonging to genera other than *Gossypium* gave positive results only on wounded chilli fruits. Delinted cotton seeds soaked in a spore suspension of *C. indicum* and sown in germination trays gave 24 per cent. germination, as against 80 per cent. for the uninoculated controls. Inoculated seeds sown in sterilized soil also showed reduced germination, and the seedlings that emerged were diseased. Evidence was also obtained that the disease may be carried through the soil. The fungus grew well on media containing sucrose, maltose, or glucose, and readily utilized nitrogen in the form of asparagin, peptone, or potassium nitrate. As the proportion of carbon to nitrogen declined, so growth was reduced, the optimum occurring near 32°. Cotton seedlings placed in a filtrate of the fungus wilted.

T. lignorum suppressed colonies of *Pythium* spp. from ginger soft rot when the organisms were grown together. In mixed cultures, *T. lignorum* so increased the acidity of the medium that it became unfavourable to the growth of *Pythium*.

Zinc sulphate sprays were successfully applied against mottle leaf of Nagpur Santhra tangerine, Kodur Cheeni and Batavian oranges, and pomelo (*Citrus decumana*) [*C. maxima*: ibid, xviii, p. 308].

The sugar-cane variety Co 205 was again resistant to mosaic, while Co 434, Co 511, and Uba A were unaffected. In three years' trials Co 434 has consistently shown high resistance. Co 511 was resistant throughout two years' trials.

Five apparently different tobacco mosaic strains were distinguished.

Of 36 brinjal [eggplant] varieties tested under natural conditions all were susceptible to little leaf, which was transmitted by grafting to tomato, tobacco, *Datura fastuosa*, *Solanum xanthocarpum*, *S. torvum*, *S. trilobatum*, and a wild variety of eggplant. Successful transmissions were obtained with the jassid *Eutettix phycitis* and, less consistently, with *Empoasca devastans*.

PAUL (W. R. C.). **Report on the work of the Division of Plant Pathology.** —*Adm. Rep. Dir. Agric. Ceylon, 1938*, pp. D41–D45, 1939.

In this report on plant disease work in Ceylon in 1938 [cf. *R.A.M.*, xviii, p. 655], it is stated that a root disease of lime (*Citrus aurantiifolia*) caused by a species of *Rosellinia* was reported for the first time; no fructifications were noted, but from the characters of the fungus as seen on the roots it appeared to resemble *R. bunodes*. Specimens of scab lesions on rough lemon leaves submitted to Dr. Anna Jenkins for identification were considered by her to suggest infection by *Sphaceloma fawcettii scabiosa* [ibid., xvi, p. 527]. Small, brown to orange, corky lesions on two grapefruits were identified by Fawcett and Miss Jenkins as sour orange scab [*Elsinoe fawcetti*]. Citrus leaves from a dry locality bore small, silvery spots, which developed first on the upper surface and in older leaves on the lower surface as well, these symptoms resembling those due to manganese deficiency.

Experimental evidence showed that roguing and the application of farmyard manure or sulphur were all ineffective against tomato bacterial wilt (*Bacterium solanacearum*), but that late transplanting did not aggravate the disease.

Other diseases that occurred included root disease (*Poria hypolateritia*) of *Tephrosia vogelii* [ibid., xvi, p. 635], stem disease (*Colletotrichum piperis*) and leaf spot (*Bacterium betle*) of betel (*Piper betle*), and twig disease (*C. incarnatum*) of coffee [ibid., ii, p. 7]. Among new records are cited root disease of *Coffea* sp. due to *P. hypolateritia* and stem disease of soy-bean caused by *Rhizoctonia bataticola* [*Macrophomina phaseoli*]. No authentic cases of cassava mosaic have so far been reported.

WARD (F. S.). **Annual Report of Plant Pathologist for 1938.**—*Rep. Dep. Sci. & Agric. Jamaica, 1938*, pp. 90–93, [? 1939. Received February, 1940.]

In this report on plant disease work in Jamaica in 1938 [cf. *R.A.M.*, xviii, p. 92] it is stated that in spraying tests against banana leaf spot (*Cercospora*) [*musae*: ibid., xviii, p. 328] promising results were obtained with perenox ($\frac{1}{4}$ to $\frac{1}{2}$ per cent.). Where, largely owing to unfavourable weather, control was inadequate, satisfactory results ensued when the applications were made at intervals of two, instead of three, weeks, for a short period. For ratoons, the rate of application was temporarily standardized at 200 gals. per acre, and for young plants at 100 to 150 gals. per acre. On many demonstration plots dusting gave unsatisfactory results, and spraying has been adopted. Owing to the difficulty of manipulating spraying machines with tanks on wheels in some areas, many of the machines have been adjusted so that the engine and pump can be detached and carried by two men from barrel to barrel of spray mixture.

When banana stems from healthy plants and plants affected with *C. musae* were stored at 52° to 53° F. for 14 days and then ripened for 7 days, the fruit from the affected trees compared favourably, as regards normal ripening and flavour, with that from the healthy trees, but the stems from the affected trees showed more thin and short fingers than the stems from the healthy trees.

During 1938, 854,897 banana plants were found to be affected with Panama disease [*Fusarium oxysporum* var. *cubense*], as compared with 800,959 in 1937, an increase of 6½ per cent.

Groundnuts in isolated areas were affected by *Puccinia arachidis* [ibid., xviii, p. 141]. A serious reduction in pimento (*Pimenta officinalis*) yields has been caused by *P. psidii* [ibid., xvii, p. 554] at altitudes over 2,000 ft. but no material harm has been done below 1,000 ft. Sugar-cane leaf spot (*Cercospora vaginae*) [ibid., xviii, p. 624] was occasionally noted on the variety BH 10–12. Coffee growing in the Blue Mountain area was slightly affected during rainy periods by *Omphalia flavida* [ibid., xviii, p. 589]. White and yellow yams (*Dioscorea alata* and *D. cayennensis*, respectively) were attacked by a leaf spot apparently due to *Gloeosporium pestis* [ibid., xv, p. 137].

WORTLEY (E. J.). **Trinidad and Tobago. Administration Report of the Director of Agriculture for the year 1938.**—85 pp., 1939.

This report [cf. *R.A.M.*, xvii, p. 728] contains (pp. 8–13) the following items of phytopathological interest. Witches' broom of cacao [*Marasmius perniciosus*: see below, p. 266] was controlled on the Marper Estate at a cost of $5.19 per acre, not allowing for supervision. In continued trials to find disease-resistant trees, only a few of the 150,000 critically examined still gave evidence of resistance. Panama disease of bananas [*Fusarium oxysporum* var. *cubense*] continued to increase, and leaf spot [*Cercospora musae*] has made rapid headway all over Trinidad, little control work being carried out against either disease. Grapefruit scab [*Elsinoe fawcetti*], which up to the early part of the year was only found in the Santa Cruz and Maraval Valleys, has since been discovered in a mild form in various parts of the island. A survey made on all plantations in the island (involving 232 properties with a total of 209,752 trees) showed that 23 properties with a total of 3,176 trees were affected. Spraying experiments in Santa Cruz gave encouraging results.

WIEHE (P. O.). **Division of Plant Pathology.**—*Rep. Dep. Agric. Mauritius, 1938*, pp. 34–39, 1939.

In this report on plant disease work in Mauritius in 1938 [cf. *R.A.M.*, xviii, p. 374] the author states that the three major tobacco diseases present are black shank [*Phytophthora parasitica* var. *nicotianae*], mosaic, and Granville wilt [*Bacterium solanacearum*]: in one district a serious outbreak of wilt developed in a field that had been allowed to lie fallow since being infected six years before. Enation mosaic occurred in four plantations. Seven distinct types of tobacco mosaic symptoms have now been observed in Mauritius.

Experimental evidence demonstrated conclusively that pineapple wilt [cf. ibid., xvii, p. 300] is due locally to attack by the mealy bug *Pseudococcus brevipes*.

An outbreak of pigeon pea wilt at the central experiment station was found to be due to *Gibberella fujikuroi* var. *subglutinans*.

New records included loquat die-back (*Corticium salmonicolor*).

SYMOND (J. E.). **Report on the Department of Agriculture, Gold Coast, for the years 1937–39.**—22 pp., 1939.

In view of Dade's report on cacao swollen shoot in the Gold Coast

[*R.A.M.*, xvii, p. 224], a campaign of reafforestation and the restoration of shade and shelter was undertaken in the area concerned. By April, 1938, 25 nurseries had been established in the affected zone with stocks of local and exotic trees, and 750,000 seedlings were available for planting in 1939. Symptoms have not yet appeared in the Central Province, but the need to replace shade and shelter in this area is recognized. No evidence has yet been obtained that any parasitic organism is associated with the disease, but it has been noted that the condition occurs on well shaded and sheltered trees showing no die-back, though usually in the vicinity of die-back trees.

The continued export of Cavendish bananas having become economically impracticable, the decision was made in 1938 to change to Gros Michel. Panama disease [*Fusarium oxysporum* var. *cubense*] was found in the Nsuaem area. Treatment and precautionary measures were prescribed under the Plant Pests and Diseases Ordinance No. 30 of 1937, planting was suspended, a survey made, and a quarantine put on the affected farms. There is every reason to hope that spread has been arrested and that infection is confined to a comparatively small area.

Further investigations into root rot of coco-yams (*Colocasia* [*antiquorum*] and *Xanthosoma* [*sagittifolium*]) have so far failed to show the presence of any suspected parasites, except *Rhizoctonia* [*Corticium*] *solani* and *R. melongenae*, and pot tests of the parasitism of these fungi gave negative results. Experimental evidence, however, demonstrated the toxic effect on the growth of the plant of soil from a diseased farm, this effect being, apparently, destroyed by heat sterilization.

Tobacco was affected by leaf curl, and (at Kpeve) by black shank (*Phytophthora parasitica* var. *nicotianae*). The Sterling tobacco variety, reputedly resistant to leaf curl, is being introduced from East Africa. At two centres tobacco was attacked by collar rot (*Pythium aphanidermatum*), and attempts are being made to control the disease by seed-bed treatments. Citrus fruits were affected by scab [*Elsinoe fawcetti*] and the requisite control measures enforced.

Yu (T. F.). **A list of important crop diseases occurring in Kiangsu Province (1934–1937).**—*Lingnan Sci. J.*, xix, 1, pp. 67–78, 1940.

Most of the diseases enumerated in this survey of pathogens of economic crops in Kiangsu Province, China, from 1934 to 1937 are well known, but mention may be made of the following: *Sclerotinia miyabeana* on groundnuts [*R.A.M.*, xiii, p. 615], downy mildew (*Plasmopara nivea*) on carrots, *Pestalozzia congensis* P. Henn. causing leaf and fruit spot of loquats, leaf spot of orange (*Coniothecium citri* [cf. ibid., iii, p. 211], peach anthracnose (*Gloeosporium laeticolor*), fruit rots of pear (*Leptosphaeria pomona* and *Macrosporium pirorum*), and sorghum stripe (*Ramulispora andropogoni* Miura).

Faes (H.). **Station fédérale d'essais viticoles et arboricoles à Lausanne et Domaine de Pully. Rapport annuel 1938.** [Annual report for 1938 of the Federal Viticultural and Arboricultural Station at Lausanne and Domaine de Pully.]—*Annu. agric. Suisse*, xlv, 1, pp. 1–26, 7 figs., 1940.

The following items of phytopathological interest occur in this report

[cf. *R.A.M.*, xvii, p. 375]. Vine anthracnose (*Gloeosporium*) [*Elsinoe ampelina*: ibid., xviii, p. 502] appears to be increasing in severity on American stocks. The development of *Coniothyrium* [*diplodiella*] on artificially infected Chasselas and various types of Gamay and direct bearer grapes suggest that the resistance of these varieties to the attacks of the fungus in nature is due to the mechanical protection against hail afforded by the skins. Satisfactory control of vine diseases was achieved by the following schedule: two prophylactic applications of 15 per cent. lime-sulphur against *Oidium* [*Uncinula necator*]; one against court-noué [ibid., xix, p. 66] (10 per cent. lime-sulphur); five against downy mildew [*Plasmopara viticola*] of 1·5 to 2 per cent. Bordeaux mixture with an adhesive, and four supplementary treatments at 1·5 per cent.; and two applications of sulphur and sulphostite against *U. necator*.

None of the preparations so far tested for the control of apple mildew (*Podosphaera*) [*leucotricha*], the local incidence of which is steadily increasing [ibid., xvii, p. 375], has proved effectual. Apple and pear scab (*Venturia*) [*inaequalis* and *V. pirina*] were successfully combated by spraying with carbolineum in March, lime-sulphur and lead arsenate at the beginning of April and end of June, copper oxychloride and lead arsenate in July, and copper oxychloride alone in August.

Shot hole of cherries (*Clasterosporium carpophilum*) yielded to a dormant application of carbolineum, followed before the blossom by a blue copper oxychloride spray [ibid., xix, p. 26].

During the summer peaches in open situations received three applications of lime-sulphur, and espaliers three of a mixture of flowers of sulphur and talc against *C. carpophilum* [ibid., xix, p. 104] with good results, the number of 'gummy' fruits being very small. Peach leaf curl [*Taphrina deformans*] was well controlled by one treatment with 3 per cent. Bordeaux mixture.

GHIMPU (V.). **Sur les affections pathologiques et insectes nuisibles aux plantes cultivées en Roumanie.** [On the pathological conditions and injurious insects affecting cultivated plants in Rumania.]—*C.R. Inst. Sci. Roum.*, iii, 5, pp. 511–513, 1939.

In these notes on plant diseases in Rumania in the spring of 1939 the author states that the basal leaves of wheat were attacked (as they are every year) by *Septoria tritici* [*R.A.M.*, xvii, p. 383]. Some leaf-spotting of oats was caused by *Helminthosporium avenae* [ibid., xvii, p. 809] and *Phytomonas* [*Bacterium*] *coronafaciens*. *Begonia* plants in glasshouses were attacked by collar rot (*Asterocystis radicis*) [*Olpidium brassicae*: ibid., xviii, p. 821].

RADA (G. G.). **Departamento de Fitopatología. Memoria del Jefe de la Sección Fitopatología.** [Department of Phytopathology. Memorandum of the Head of the Section of Phytopathology.]—*Mem. Estac. exp. agric. Soc. nac. Agr., Lima,* 11a, pp. 233–284, 3 diags., 7 graphs, 1939.

Neither delayed irrigation nor applications of ammonium sulphate to the soil reduced the percentage of cotton wilt (*Verticillium* sp.) in the final counts in experiments in 1937–8 at the La Molina Agricultural Experiment Station, Lima, Peru [*R.A.M.*, xix, p. 212], though the

former treatment resulted in a diminution of infection during the growing period which was most marked (19·4 per cent.) in the Pariache variety.

Black and yellow rusts of wheat (*Puccinia graminis* and *P. glumarum*) were prevalent at the Station in 1938 [ibid., xvi, p. 520], when observations were made, mostly in October, on varietal reactions to both diseases. On 25th August Thatcher was observed for the first time to be attacked by *P. graminis* [ibid., xix, p. 10]. A very high degree of resistance to black rust was shown by the prolific Australian variety Kenya Crossbred C.6040, with only 10 per cent. of barely perceptible infection, and also by 38 M.A.×San Martín 28 (Argentine), with a similar response, in contrast to the two Italian varieties Ciro Menotti and Mentana both of which were attacked to the extent of 100 per cent. Among a number of foreign varieties and strains tested for the first time in Peru, the most promising in respect of resistance to black rust included Thatcher Backross II–30–4 and II–30–5, Thatcher 10003, H–44×Marquis 11781, and a number of crosses between H–44 and Thatcher and H–44 and D.C., all of American origin. Thatcher, Pentad (durum) 3322, and Hyper all gave substantial fields notwithstanding infection by *P. graminis* (slight in the first and severe in the two others).

Among the varieties showing marked freedom from yellow rust were the above-mentioned Kenya Crossbred C.6040, two strains of Apex, H–44×Thatcher II–29–76, H–44×D.C. II–2–7, II–28–19, Power 3967, Schlanstedt 4646, Garnet 8181, Rouge prolifique 11774, Providence, and Heine's Club, while a satisfactory standard of resistance was maintained by a large number of others, including crosses between H–44 and selections of Marquis, Ceres, Reward, Thatcher, and Reliance, Haynes Bluestem, Thatcher 10003, Renown, Ridit, four strains of Iumillo White, New Zealand 6011, Sonora 3036, and Loros 3779. On the other hand, Power 3697, Garnet 8181, Apex 11636, and H–44× Thatcher II–29–76 were highly susceptible to *P. glumarum*.

Of the 13 varieties of oats tested, Victoria, Bond, and Glabrota proved immune from crown rust (*P. coronata*), combined in the two first-named with freedom from smuts [*Ustilago avenae* and *U. kolleri*]. Resistance to *P. coronata* was shown by Fergusson, Fulghum, Rainbow, and Anthony, to *P. graminis* by Hegira, White Tartar, Richland, Iogold, and Rainbow [ibid., xix, p. 206], and to the smuts by Navarro and Markton. The two American barley varieties included in the trials, namely, California Mariout and Wisconsin Barbless were both slightly infected by black rust.

Details are given of experiments in the control of *P. graminis* on Mentana and Marquis wheats by dusting with asporital [ibid., xvii, p. 227] at the rate of 50 kg. per hect., from the results of which it appears that the former variety was entirely unaffected by the treatment, whereas the latter responded by a slight improvement in yield, though the incidence of infection was not reduced.

Sorghum mosaic [ibid., xviii, p. 517], observed for the first time at the Station in March, 1938, spread to the adjacent sugar-cane plantations, also hitherto unaffected, no doubt through the agency of *Aphis maidis*. Inoculation experiments on healthy sorghum plants with juice

from diseased ones gave positive results. The virus does not appear to be seed-borne, since plants raised from the seed of infected individuals remained free from symptoms.

Of the seven mosaic-resistant American potato varieties tested for their adaptability to Peruvian conditions, only two, Katahdin and Sebago [ibid., xvii, p. 302; xviii, p. 544], gave results of any interest from this point of view. A project for the introduction of the seed certification system into Peru has been initiated. The outcome of preliminary experiments in the control of potato blight (*Phytophthora infestans*) by (*a*) standard Bordeaux mixture (1–1–100) and (*b*) a modified formula (1–½–100) denoted that the latter is more conducive to normal foliar development than the former, the larger amount of calcium in which tends to coarsen the leaves, as already noted by Horsfall in the United States.

The following diseases were observed during 1938 for the first time in Peru: *Sphaeronema fimbriatum* [*Ceratostomella fimbriata*] on sweet potatoes, *Cercospora personata* [ibid., xix, p. 62] on groundnuts, *Pestalozzia theae* and *Cephaleuros mycoidea* on tea, *Peronospora effusa* [loc. cit.] on quinoa [*Chenopodium quinoa*], and *Puccinia graminis* on various species of barberry, including *Berberis divaricata*.

WALDEE (E. L.), KENT (G. C.), & MELHUS (I. E.). **Classification and nomenclature of some phytopathogenic species of Bacillus.**—Abs. in *Phytopathology*, xxx, 1, p. 26, 1940.

At least three well-marked generic groups were differentiated on the basis of a preliminary study of 46 cultures of reputedly phytopathogenic species of *Bacillus*, using the 1934 descriptive chart of the Society of American Bacteriologists for the determination of taxonomic status. Three species, formerly known as *B. amylovorus*, *B. tracheiphilus*, and *Bacterium salicis* [*R.A.M.*, xvii, p. 356], constitute one group, the second is occupied by the soft rot bacteria (24 isolates), and the third by two isolates designated *B. lathyri*. Group I represents a generic group based on the type species, *Erwinia amylovora*, and also includes *E. tracheiphila* and *E. salicis* (Day) Bergey *et al.*, 1939 [ibid., xix, p. 203]. Group II, comprising the soft rot organisms, belongs to the coliform bacteria, with which it should be classified in a new genus in the tribe Escherichiae, as proposed by Bergey and associates. The systematic position of the two species of bacteria falling within the limits of group III requires further elucidation.

ARK (P. A.). **Relation of reducing substances to longevity and virulence of phytopathogenic bacteria.**—Abs. in *Phytopathology*, xxx, 1, p. 1, 1940.

The duration of life of *Erwinia amylovora*, *Phytomonas* [*Bacterium*] *malvacearum*, *P.* [*Bact.*] *pisi*, and *P.* [*Aplanobacter*] *stewarti* was prolonged by the incorporation with the potato dextrose-peptone agar medium on which these organisms were grown of vitamin C (1 : 200 to 1 : 1,000,000), cysteine (1 : 1,000), glutathione (1 : 1,000), pyrogallol (1 : 1,000), resorcinol (1 : 10,000), and tannic acid (1 : 100 to 1 : 10,000). The added viability thus conferred was found to be retained by the bacteria for some time after transference to substrata devoid of the

reducing substances. *E. amylovora*, for instance, lived for six months instead of a fortnight when transferred to a plain potato dextrose-peptone agar medium after two months in the presence of vitamin B (betoxin, 15 mg. per l.) or resorcinol. The virulence of the pathogen diminished after one to four months on the nutrient medium plus the reducing agent, but was rapidly restored by transference to a substratum of a very low reduction potential or with no reducing agent.

MATSUMOTO (T.). **Phage-produced resistant strains of Bacillus aroideae. I. Resistant strains appeared in culture solutions.**—*Trans. nat. Hist. Soc. Formosa*, xxix, 195, pp. 317–338, 1939.

It was found that the bacteriophage specific for *Bacillus* [*Erwinia*] *aroideae* from radishes can be satisfactorily prepared by 30 minutes' heating of phage-bacteria mixture at 60° C., instead of by ultrafiltration, the method used in the author's previous experiments [*R.A.M.*, xviii, p. 162]. The maximum accumulation of the bacteriophage is usually reached after an incubation period of 18 to 30 hours at 31°, whereupon a gradual diminution ensues, the lytic action being barely perceptible after ten days.

Two forms of *E. aroideae* (tentatively designated M and F) are distinguished. The former is characterized by colonies with reticulate markings and the latter by fluid, unmarked ones: no conspicuous differences in sensitivity to the bacteriophage were observed between them. The so-called 'bacteriophage-resistant' strains usually develop in the phage-bacteria mixtures within 12 hours at 31°, gradually multiply, and after 24 hours the ordinary forms are outnumbered. No definite correlation could be established between bacteriophage-sensitivity and agglutinability in *E. aroideae*, since the conversion of the normal form of the organism into resistant strains does not necessarily entail loss of agglutinability in the antiserum in dilutions up to 1 in 400. Little or no relation, moreover, appears to exist between the acquisition of resistance to the bacteriophage and the pathogenicity and fermentative activity. The bacteriophage-susceptible strains occurring in the later stages of incubation are thought to be possibly variants arising from the resistant forms after the decline or loss of the lytic activity.

POUND (F. J.). **Witches' broom resistance in Cacao.**—*Trop. Agriculture, Trin.*, xvii, 1, pp. 6–8, 1940.

In this paper, prepared for the Imperial Mycological Conference of 1939, which had to be abandoned on account of the war, the author summarizes the results of recent travels in South America [*R.A.M.*, xvii, p. 801] in search of cacao resistant to witches' broom caused by *Marasmius perniciosus* [see above, p. 261]. This disease is stated to have appeared in Tobago quite recently. The following practical questions arise from the author's observations. Should resistant cacao in future be grown with as little overhead shade as possible, as suggested by the lack of infection, in some varieties at least, in full sunlight? Is altitude an ecological factor retarding the rapid spread of the disease (e.g. in the Northern Range, Trinidad), possibly through inability of the parasite to thrive at high altitudes? Thirdly, are the types of cacao

on the upper Amazon, found uninfected even under shade, completely immune or not?

ANDRÉN (F.). **Några resultat från betningsförsök.** [Some results of disinfection experiments.]—*Växtskyddsnotiser, Växtskyddsanst., Stockh., 1939*, 4–5, pp. 75–82, 1939.

A tabulated account is given of laboratory and field experiments in the disinfection of cereal seed-grain against various fungal diseases carried out at the Swedish Plant Protection Institute, Stockholm, in 1939 [cf. *R.A.M.*, xiv, p. 21]. The best control of rye fusarioses (including snow mould [*Calonectria graminicola*]) was obtained by the following treatments: dusting with uspulun [ceresan] U.T. 1875b at the rate of 150 gm. per kg. (which reduced the percentage of infection from 45·4 to 8·4), the same at 200 gm. (5·2), abavit-neu at 150 (6) and 200 gm. (6); 30 minutes' immersion in 0·125 per cent. abavit (5·6), 0·25 per cent. abavit (4·8), 0·125 per cent. germisan (8·8), 0·25 per cent. germisan (8·4), in 0·25 per cent. fusariol 157 (5·6) [ibid., xv, p. 83], and 0·1 per cent. germisan retorte (5·2); and sprinkling with abavit (8·4), fusariol 157 (7·2), and gefa retorte (5·6), each used at a strength of 50 gm. per 3 l. Fusarioses of white oats [*Fusarium* spp.] were effectively combated by all the treatments applied, the incidence of infection being reduced from 68 to 7·6 per cent. by ceresan dust U.T. 1875b (300 gm.), to 6·4 per cent. by uspulun sprinkle, to 5·6 per cent. by uspulun liquid (0·25 per cent., one hour's immersion), to 1·2 per cent. by germisan dust (300 gm.), to 4·8 per cent. by germisan retorte (0·25 per cent., 30 minutes' immersion), and to 4·4 per cent. by gefa retorte, while the average of germination was raised from 77·2 to 91·3 per cent. The results with spring wheat were less satisfactory, the two best treatments (germisan dust, 200 gm. and an unnamed Swedish disinfectant, 175 gm.) leaving residues of 13·6 and 14 per cent. fusariosis, respectively, as against 52 per cent. in the control lot. The highest increases in the yield of white oats were obtained from uspulun liquid and gefa retorte treatments (each 3,340 kg. seed-grain per hect. as compared with 1,650 untreated), while germisan retorte (0·25 per cent., 30 minutes' immersion) gave the strongest stimulus to spring wheat (2,490 kg. seed-grain per hect. as against 2,110 untreated and 2,430 for germisan dust).

All the preparations reduced the incidence of bunt in winter wheat [*Tilletia caries* and *T. foetens*] from 28·6 to less than 1 per cent., but absolute freedom from infection was obtained only by the use of uspulun and tutan dust (200 gm.), and 0·125 per cent. uspulun, abavit, fusariol, and germisan liquid (30 minutes). Flag smut of rye [*Urocystis occulta*] was effectively combated by all the treatments, only 0·125 per cent. germisan liquid and abavit sprinkle leaving a trace of infection.

The incidence of barley stripe [*Helminthosporium gramineum*] was reduced from 25·5 to a fraction of 1 per cent. by uspulun, abavit-neu, germisan dusts, all the standard liquid treatments, and uspulun sprinkle.

Complete elimination of loose smut of oats [*Ustilago avenae*] was secured only by 15 minutes' immersion in 0·25 per cent. uspulun or germisan plus 0·1 per cent. formalin, but reductions from 3·8 (untreated) to under 1 per cent. were obtained by dusting with uspulun or abavit-neu, half-an-hour's or an hour's immersion in 0·25 per cent. uspulun,

germisan, abavit, or germisan retorte, one hour in 0·25 per cent. fusariol 157, 15 minutes in 0·1 per cent. mercuric chloride-formalin or fusariol 157 plus 0·1 per cent. formalin (only 0·03 per cent. infection in each case), 15 minutes in 0·25 per cent. germisan retorte plus 0·1 per cent. formalin, and sprinkling with abavit and gefa.

Borzini (G.) & Marini [Bettòlo] (G. B.). **Composti furanici e mercuri-furanici come anticrittogamici nazionali.** [Furfuran and mercuri-furfuran compounds as national fungicides.]—*Ric. sci. Progr. tec. Econ. naz.*, Ser. 2, x, 5, p. 474, 1939.

The satisfactory results obtained in preliminary experiments at the Phytopathological Station of Rome University with furfuran derivatives, especially of the chloromercuric group, in the control of wheat bunt (*Tilletia tritici*) [*T. caries*: cf. *R.A.M.*, iv, p. 32; vi, p. 568; xi, p. 296, *et passim*] encourage the hope of their application on a large scale in Italy. Even at low concentrations the compounds tested were toxic to the fungus and stimulatory to the initial growth of the wheat. In addition to these advantages another important factor is the home production both of furfurol and mercury. Further trials are in progress to determine the optimum concentrations of the substances for the purpose in view.

[An expanded account of these studies appears in *Boll. Staz. Pat. veg. Roma*, N.S., xix, 4, pp. 347–452, 1 fig., 1939. (Issued March, 1940.) [English summary.]

Zazhurilo (V. K.) & Sitnikova (Mme G. M.). **Mosaic of winter Wheat.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxv, 9, pp. 798–801, 1 fig., 1 map, 1939.

Mosaic of wheat [*R.A.M.*, xvii, p. 436; xviii, p. 297] is stated to have been recorded lately from many parts of the U.S.S.R., chiefly from the central regions, but also the south, including almost all provinces in which winter wheat is grown. The disease is most prevalent in the Voronezh province, where it occurs each year, attacking under favourable conditions up to 15 to 20 per cent. of the plants and reducing the yield by 40 to 80 per cent. The diseased plants show necrosis of the phloem, under-development and reduction of the plastids, nuclear hypertrophy and an increase in the number of nucleoli, and the formation of vacuolar inclusions within the cells. The content of starch and soluble carbohydrates was higher in diseased plants (4·97 and 17·13 per cent., respectively, of the dry weight) than in healthy ones (2·82 and 14·24 per cent.), but the amount of nitrogen was the same. All attempts to transmit the virus by mechanical means were unsuccessful. In transmission experiments with insects *Deltocephalus striatus*, fed first upon diseased plants and then upon healthy ones, transmitted the disease to 56 out of 60 plants in one experiment, to 29 out of 123 in another, and to 32 out of 41 in a third, the incubation period being 15 to 18 days. A comparison of the disease under investigation with other virus diseases of cereals in the U.S.S.R. showed it to have many properties in common with the pupation disease of oats [ibid., xviii, p. 666], from which it differs, however, in the absence of protein

crystals from the cells of mosaic plants, the different vector, and the longer incubation period.

KOSTOFF (D.). **Effect of the fungicide 'granosan' on atypical growth and chromosome doubling in plants.**—*Nature, Lond.*, cxliv, 3642, p. 334, 1939.

In experiments at the Moscow Institute of Genetics the writer found that the treatment of germinating grains of rye, wheat, *Triticum persicum*, *T. durum*, *T. polonicum*, and *T. aegilopoides* with 0·5 to 0·1 per cent. granosan [*R.A.M.*, xviii, pp. 115, 137] (containing 0·01 to 0·002 per cent. ethyl mercury chloride), for three to six (or up to 21) days resulted in swellings of the root tips and of the whole seedlings. A cytological study of the affected material revealed abnormal mitoses similar to those induced by colchicin and acenaphthene and involving failure of achromatic figures, chromosome multiplications, multinucleations, and formation of large amoeboid nuclei. Chromosome doubling and large nuclei were also characteristic of the root tips of similarly treated peas. Germinating seeds immersed in granosan for the induction of polyploidy are not attacked by fungi, which usually cause serious infection of those treated with colchicin.

GARRETT (S. D.). **Utilization of nitrogen by Ophiobolus graminis.**—*Nature, Lond.*, cxlv, 3664, pp. 108–109, 1940.

In further experiments with *Ophiobolus graminis* [*R.A.M.*, xviii, p. 386] chaffed wheat straw (6 gm.) was bottled with 24 ml. of either water or calcium nitrate solution (corresponding to 0·25 gm. of nitrogen per 100 gm. air-dry straw), autoclaved for 30 minutes and inoculated with pure cultures of the fungus. The average loss in dry weight after incubation for three and six months at 25° C. was 21 and 23 per cent., respectively, in the water series, and 27 and 33 per cent., respectively, in the calcium nitrate series. In the latter the amounts of nitrate nitrogen present in the sterilized but not inoculated control, in the straw inoculated and incubated for three months, and in that inoculated and incubated for six months were 240, 13, and 0 mg. per 100 gm. air-dry straw, respectively, indicating (in support of Padwick's conclusions [ibid., xv, p. 490]) that pure cultures of *O. graminis* growing on sterilized wheat straw can utilize nitrate nitrogen.

WINTER (A. G.). **Weitere Untersuchungen über den Einfluss der Bodenstruktur auf die Infektion des Weizens durch Ophiobolus graminis.** [Further investigations on the influence of the soil structure on the infection of Wheat by *Ophiobolus graminis*.]—*Zbl. Bakt.*, Abt. 2, ci, 18–20, pp. 364–388, 6 figs., 2 graphs, 1940.

Further studies at the Bonn Phytopathological Institute on the relation of soil structure to the infection of wheat by *Ophiobolus graminis* [*R.A.M.*, xix, p. 204] led to the following conclusions. The failure of attempts to demonstrate the inhibitory effect of soil consolidation on the infection of plants in pot experiments is attributed to the fact that primary invasion usually takes place at a point in the root system more or less remote from the stem base. Such being the case, the moment at which the 'runner' hyphae reach the stem base and begin

the disorganization of the central vascular tissue is a critical one in the course of the disease, and although the growth rate of the 'runners' and consequently their time of arrival at the stem base is greatly delayed by consolidated soil, the adverse effect on the fungus can only be judged by the maintenance of a certain distance between seed-grain and inoculum so as to avoid immediate infection of the stem base.

The retardation of infection in a compact soil does not at once become apparent; the superior development of the plants being noticeable only when the 'runners' have advanced to the stem bases in the loose soil and destroyed all the roots. The differences in the growth rate of the two series of plants beginning at this juncture persist until the 'runners' have also reached the stem bases in the compact soil. The time occupied by this differential mode of development, designated the protective period of soil consolidation, ranged from 12 to 36 days at distances of 0 to 15 cm. between the seed-grain and the inoculum. To cite some experimental figures, at 6 cm. the differences in development between the plants in the loose and compact soils began to be perceptible after a fortnight from sowing, increased up to the 25th day, and disappeared after the 31st, when those in both series were dead. At 9 cm. the protective period only commenced on the 19th day after sowing, reached a maximum after 37 days, when the average lengths of the plants in the compact and loose soils were 28·5 and 21·9 cm., respectively, and did not terminate until the 45th day. In the 12 cm. series on the 40th day after sowing (five days before the maximum effect was reached), 43 plants in compact soil weighed 20·6 gm. and the same number in loose 9·3, the loose-soil plants having 156 leaves (106 wilted) compared with 206 (19 wilted) for the corresponding compact-soil series. These results confirm the outcome of similar experiments by Fellows and Ficke in the United States [ibid., xiv, p. 433].

Considering the possibilities of practical control of *O. graminis* by the intelligent application of the principles of soil consolidation to the 'runner' theory, the writer points out that success depends primarily on the time of commencement of the protective period, and secondarily on its duration. It should begin sufficiently late and last long enough to cover the maturation of the plants in compact soil. The method is effective only against late attacks of the fungus, resulting in the milder forms of 'white heads', not against early invasion, in the case of which the protective period both begins and ends too early to ward off the parasite even in compact soil.

There are two points of special importance to be borne in mind in the assessment of the influence of environmental factors on the success of the soil consolidation method of foot rot control. A sharp line must be drawn between the number of infectious soil particles per unit volume and the actual risk of infection by *O. graminis*, which also depends on the period required for the 'runners' to reach the stem base. The greater the extent of soil infestation the shorter is the distance between the site of infection and the stem base, since the roots will sooner encounter the contaminated particles in their penetration of the soil. Taking these relationships into account, the influence on the beginning of the protective period and thus on the outcome of the treatment on the likelihood of infection, the consolidation quotient (defined as the

percentual decrease in the growth rate of the 'runner' following consolidation of a loose soil), and various external factors, such as the nature and degree of soil infestation and the growth rate of the 'runners', may be defined by the aid of simple mathematical formulae.

Bockmann (H.). **Fruchtfolge und Halmbruchkrankheit bei Getreide.** [Crop rotation and eyespot lodging of cereals.]—*Landw. Jb.*, lxxxix, 3, pp. 393–412, 4 diags., 1939.

This is an account of the writer's observations on the relation of crop rotation and other cultural practices to the incidence of *Cercosporella herpotrichoides* on cereals, especially winter wheat and barley, in Schleswig-Holstein [*R.A.M.*, xviii, p. 586]. In most cases the attack of *C. herpotrichoides* can be prevented by a single exclusion of wheat from the sequence, but under present conditions such a step is undesirable unless the consequent shortage of grain for milling can be made good by the interposition of a rye crop. Another possibility is to extend the area under wheat and thereby minimize the risks of loss through disease. Strict attention to crop rotation with non-Gramineae and to shallow, sparse, and late sowing should serve in the generality of cases to reduce the damage from *C. herpotrichoides* to a reasonable limit.

Kingsolver (C. H.) & Murphy (H. C.). **Physiologic race determination in Puccinia coronata avenae.**—Abs. in *Phytopathology*, xxx, 1, pp. 13–14, 1940.

A study of the reaction of 21 varieties of oats to 21 single-pustule isolates of crown rust (*Puccinia coronata avenae*) collected in 16 States of the American Union was made at the Iowa Agricultural Experiment Station in 1938. The varieties comprised those used for physiologic race determination by Murphy in the United States [*R.A.M.*, xiv, p. 435; xvi, p. 245] and Straib in Germany [ibid., xvii, p. 233]. On the basis of Murphy's 13 varieties it was possible to identify 19 races, on that of Straib's 15 varieties 46, and with the whole assortment of 21, 54. Twenty-four isolates identified as Murphy's race 1 could be separated into 18 races by their reaction on Straib's varieties, while 28 of race 6 fell into 16 by the same criterion. Twelve isolates giving the same reaction on Straib's varieties were separable into two races (1 and 6, accommodating 3 and 9 isolates, respectively) by their reaction on Murphy's assortment. Of the 19 races identified by means of Murphy's varieties, six were new. Races 1 and 6, in practically equal ratios, accounted for over 50 per cent. of the total number. Race 47, originally differentiated by Waterhouse in Australia [ibid., xv, p. 635], was identified in two collections, this being its first appearance in the United States. Race 7, formerly one of the most prevalent, was only twice recognized.

Rosen (H. R.), Weetman (L. M.) & McClelland (C. K.). **Hybridizing Oats to combine growth for winter pasture, hardiness, and resistance to rusts and smuts.**—*J. Amer. Soc. Agron.*, xxxii, 1, pp. 12–14, 1940.

Among the 28 promising oat hybrids in course of development at the Arkansas Agricultural Experiment Station for resistance to rusts [*Puccinia graminis* and *P. coronata*] and smuts [*Ustilago avenae* and

U. kolleri: *R.A.M.*, xix, p. 206] conjoined with hardiness and suitability for winter pasture [ibid., xix, p. 11] may be mentioned the following, now in the F_4 or F_5 generations: Coker's 32–1 × Victoria and its reciprocal, Tennessee 1884 × Bond, Tennessee 1922 × Bond, Fulghum 3232 × Bond, Lee × (Victoria × Richland) and its reciprocal, Custis × (Bond × Iogold) and its reciprocal, Hairy Culberson × Bond, Coker's Fulgrain 33–19 × (Victoria × Richland), Victoria × Custis, and Victoria × Coker's Fulgrain 33–19. While some of the hybrids obtained appear to be homozygous for resistance to rusts and smuts and for winter growth and hardiness, a relatively large number are still segregating. The chief emphasis has been placed on breeding for much needed winter forage but grain characters have also been considered.

Derick (R. A.) & Hamilton (D. G.). **Further studies on Oat blast.**—*Sci. Agric.*, xx, 3, pp. 157–165, 1939.

Further studies on 'blast' disease of oats in Canada [*R.A.M.*, xvi, p. 310] showed that the disease exercises a marked effect on yield, the actual loss being directly related to the amount of blast present. In five varieties showing 0 to 10 per cent. blast the average number of spikelets per panicle ranged from 27·69 to 45·12, and the average yield per panicle from 1·94 to 2·26 gm., the corresponding figures for plants with 10·1 to 20 per cent. blast being 27·19 to 44·62, and 1·52 to 1·82, while for plants with over 30·0 per cent. blast they were 23·98 to 37·59, and 0·81 to 1·17, respectively. The average decrease in yield per blasted spikelet for the same varieties ranged from 0·028 to 0·117 gm.

No statistical relation was found between the number of blasted spikelets and the total number of spikelets (fertile and infertile), except in the variety Eagle for which the correlation was negative and significant. Evidence indicated that the physiological conditions associated with the causes of blast may adversely affect the development of the remaining fertile spikelets. Varieties with similar amounts of blast may show differences in loss of yield, the varietal reaction depending on genetic factors.

Anerud (K.). **Mjöldryga och ergotism.** [Ergot and ergotism.]—*Landtmannen, Uppsala*, xxiii, 49, pp. 1185–1188, 3 figs., 1939.

The writer has assembled some interesting data on the history of ergot (*Claviceps purpurea*) and ergotism from earliest times to the present day. As in other countries, rye is the cereal crop chiefly affected in Sweden, though six-rowed barley is also liable to attack in the north, and in 1938 the spring wheat crop in northern Bothnia suffered too, the last case being very exceptional, while there is no authentic record of the fungus on oats in the country. The gradual decline in the severity of the disease is attributed to improved methods of cultivation, including the use of clean seed, deep ploughing, judicious crop rotation, and the selection of varieties with a short, regular flowering period to minimize the changes of infection during the critical time. The first credible report of an epidemic of ergotism [*R.A.M.*, xi, 445] is stated to date from 857 from the Lower Rhine. During the period from 1745 to 1867 there were ten outbreaks of the disease in Sweden, while both Finland and Russia [ibid., xix, p. 209] have fre-

quently experienced severe visitations; in the former country the mortality during the epidemic of 1862-3 was estimated at 2·7 to 22·7 per cent., and in the latter it has on occasion risen to 50 per cent. The Russian outbreak of 1926–7 [ibid., ix, p. 103] is calculated to have involved at least 2 per cent. of the population of 506,000 in the affected region. The exceptionally cold and wet weather during the summer of 1926 resulted in a poor harvest of rye and an abnormally high one of sclerotia of *C. purpurea* (4,000 tons in the area under observation). A proportion of 1 per cent. sclerotia among the rye flour is believed to have caused illness, while 7 per cent. led to acute poisoning.

Most of the ergot for medicinal use originates in Spain and Russia, but it is often difficult with modern methods of cultivation to procure sufficient quantities by natural means; this necessitates the artificial infection of the crop with the aid of conidial suspensions [ibid., xix, p. 95], giving a yield of up to 527 kg. sclerotia per hect. which represents a value of Kr. 5,000 at prevailing prices.

Békésy (N. v.). **Untersuchungen über den Alkaloidgehalt des Mutterkornes. II. Mitteilung: Über den Alkaloidgehalt des parasitisch kultivierten Mutterkornes.** [Studies on the alkaloid content of ergot. Note II: On the alkaloid content of parasitically cultivated ergot.]—*Biochem. Z.*, ciii, 5–6, pp. 368–382, 1 fig., 3 graphs, 1940.

In the writer's further studies on the factors affecting the intensive production of rye ergot [*Claviceps purpurea*] in Hungary [*R.A.M.*, xix, p. 94, and cf. preceding abstract], environmental factors were found to play only a very minor part in the alkaloid content of the sclerotia, the extent of which rests primarily on a hereditary basis. This is a matter of great importance, since all the properties of the selected sclerotia are transmissible in field cultivation by asexual propagation. The highest alkaloid content in large-scale trials was secured from sclerotia on the Fleischmann variety and amounted to 0·74 per cent., believed to represent the maximum yet recorded.

Burnham (C. R.) & Cartledge (J. L.). **Linkage relations between smut resistance and semisterility in Maize.**—*J. Amer. Soc. Agron.*, xxxi, 11, pp. 924–933, 1 diag., 1939.

Crosses between chromosomal interchange lines of maize susceptible to smut [*Ustilago zeae*: *R.A.M.*, xviii, p. 670] and a resistant Lancaster Surecrop inbred line were back-crossed at the West Virginia Agricultural Experiment Station during 1936 to 1938 to a susceptible Leaming inbred to study segregation for smut reaction in relation to the interchange points. From data obtained in 1936 smut resistance in Lancaster was found to be at least partially dominant, and under the prevailing experimental conditions the back-cross to the susceptible parent provides the best material for a study of segregation for smut reaction.

The results showed that highly significant deviations from randomness were obtained in the direction expected with linkage between smut resistance and the following interchanges: 1–2c, 1–6a, 1 9b, 2–6a, 3–8a, and 6–8a. Less significant deviations but in the same direction were obtained for 2–3a, 2–4d, 3–5a, 3–7b, 3–10a, 4–9a, and 9–10a. Of these interchanges incomplete evidence indicates that the locus of

1–2c in chromosome 2 is one of the loci showing linkage with smut reaction. In all other cases the break locus in either, or the loci in both chromosomes involved in the interchanges listed above may be associated with resistance.

ARK (P. A.). **Bacterial stalk rot of Field Corn caused by Phytomonas lapsa, n.sp.**—Abs. in *Phytopathology*, xxx, 1, p. 1, 1940.

Phytomonas lapsa n.sp., the agent of a rapid decay of the leaf and stalk parenchyma of maize, resulting from the use of diseased seed or contamination through the soil, occurred in epidemic form in California in 1937 under favouring conditions of high temperature and extreme humidity, frequently causing the collapse of the plants. It was isolated from the external parts and alimentary canal of *Diabrotica* beetles. The pathogenic bacterium, 1·55 by 0·56 μ, is motile by 1 to 4 polar flagella, producing fluorescence in Uschinsky's, Fermi's, and Cohn's solutions, and evolving acid (but no gas) from dextrose, sucrose, maltose, lactose, glycerine, arabinose, xylose, galactose, raffinose, and mannitol. Dusting the seed with semesan bel gave satisfactory control of the disease. Of the many species of plants inoculated with *P. lapsa*, sugar-cane was the only one to contract infection.

MEZZETTI (A.). **Ricerche sull' eziologia della 'piticchia batterica' dei frutti di Limone.** [Researches on the etiology of 'bacterial pitting' of Lemon fruits.]—*Boll. Staz. Pat. veg. Roma*, N.S., xix, 2, pp. 189–221; 3, pp. 251–292, 4 pl., 11 figs., 1939.

A detailed account is given of a comprehensive series of experiments undertaken to determine the etiology of bacterial pitting of oranges and lemons in Sicily, the symptoms of which appear to be identical with those of black pit and (on the twigs) citrus blast (*Bacterium* [*Pseudomonas*] *syringae*) [*R.A.M.*, xviii, p. 672], but which also resemble those attributed by Rabinovitz-Sereni in Italy and Doidge in South Africa to *Bacillus* [*Bact.*] *citrimaculans* [ibid., xii, p. 283; xvi, p. 302].

Isolations from affected fruits in most cases gave practically pure colonies of the *P. syringae* type, though others gave yellow colonies, either pure or mixed with colonies of the *P. syringae* type. No evidence was obtained to support the view that the yellow colonies belonged to *Bact. citrimaculans*.

Inoculations of healthy, wounded lemons were made with 13 strains isolated from affected orange and lemon fruits (strains h, i, j, k, η, l, m, n, o, γ, ϵ, q, r), with 9 strains isolated from twigs of bitter orange and sweet orange (strains a, b, c, d, e, f, g, α, p), one from pear leaves accidentally infected during the author's experiments (strain s), a strain of *P. pyocyanea* [*Bact. pyocyaneum*: ibid., xvi, p. 297], and a fluorescent strain (θ) from broad bean infusion. The results demonstrated that all the fluorescent strains from citrus fruits and branches and from pear leaves were pathogenic, except p; the yellow strains, α, γ, η, strain o, the brown strain, j, *Bact. pyocyaneum*, and the bean strain were not pathogenic. Inoculation of unwounded lemons by sprinkling with suspensions of the two most virulent strains (d from a blast lesion and i from a black pit lesion) gave positive results.

Syringe and needle-prick inoculations of lilac shoots with one strain from blast (b), and strains i, j, l, m, n, o, p, q, r, from black pit showed all the strains to be pathogenic except j, o, and p. Similar inoculations of pear shoots with the same strains (except i) showed that strains b, m, q, and r were pathogenic, j, o non-pathogenic, and p, l, and n uncertain.

A study [which is fully described and the results of which are tabulated] of the morphology and biochemical properties of these strains showed that strains b, e, g, i, n, r, s, ϵ agreed with *P. syringae*, strain j fell into a group by itself, strains o, α, γ, η formed a third group, and strains p, *Bact. pyocaneum*, and θ fell into three further groups.

A bibliography of 73 titles is appended.

GODFREY (G. H.) & FRIEND (W. H.). **Diplodia stem-end rot of lemons controlled with sodium ethyl mercuri thiosalicylate.**—*Science*, N.S., xci, 2352, pp. 94–95, 1940.

The effective control of certain animal fungi by merthiolate [*R.A.M.*, xiv, p. 695] or sodium ethylmercurythiosalicylate suggested the application of the compound in the treatment of stem-end rot of lemons (*Diplodia*) [*natalensis*], and experiments in this direction in the autumn of 1939 at the Lower Rio Grande Valley Substation, Weslaco, Texas, gave very encouraging results. Used as a tincture at a strength of 1 to 1,000, the chemical reduced the incidence of infection from 84 to 0 per cent. in a three weeks' trial, while almost equally thorough elimination was secured with dilutions of 1 to 5,000. Sulfomerthiolate or sodium para-ethylmercurythiophenylsulphonate also proved very successful for the purpose in view. The treatments were applied by a 'stamp pad' method, in which a piece of heavy felt in a non-corrosive holder was kept moistened with the antiseptic solution. The individual fruits were pressed with their stem ends against the felt with a slight twisting motion (through about 60°), entailing the complete wetting of the button and adjacent rind. Total immersion for two minutes in 1 to 10,000 dilutions of both merthiolate and sulfomerthiolate gave 99 to 100 per cent. control in late-season tests, while the untreated fruits developed 27 to 35 per cent. decay in three weeks. While these chemicals are expensive, the cost of the treatment by the pad method is almost negligible in comparison with losses frequently encountered in untreated or improperly treated fruit.

BRIXHE (A.). **Le wilt du Cotonnier.** [Cotton wilt.]—*Bull. Com. coton. congol.*, iv, 15, pp. 79–82, 2 figs., 1939.

This is a summary of the writer's observations in the United States on American methods of combating the *Fusarium* wilt of cotton (*F. vasinfectum*), with a view to their application in the Belgian Congo, where the presence of the disease has recently been established [*R.A.M.*, xviii, p. 797].

ROBERTS (ELIZABETH O.). **Conidial germination of the Cotton root-rot fungus.**—*Bull. Torrey bot. Cl.*, lxvii, 1, pp. 77–78, 1940.

In germination tests with conidia of the cotton root-rot fungus,

Phymatotrichum omnivorum [*R.A.M.*, x. p. 186], conducted in Texas, maximum germination, which never exceeded 5 per cent., occurred in conidia stored for three days or more at 5° C. previous to the test and then (after treatment with mercuric chloride solution) incubated at 30° in darkness for three days on the following media: egg albumen, potato dextrose, and Weindling's agars, potato dextrose and manure decoction broth, and potato dextrose agar plus either yeast extract or manure. Germ-tubes frequently reached a length of 34 μ, their average duration being three days. The low percentage of germination obtained is attributed in part to the treatment with mercuric chloride. Spores stored at room temperature for several months and failing to germinate developed germ-tubes after subsequent storage at 5°, indicating that dormancy rather than non-viability may account for the failure of the spores to germinate. Other incubation conditions and media tested showed reduced or no germination. It is suggested that the failure of the germinated conidia to continue development may be explained by the assumption that the fungus is heterothallic and that cultures so far tried contain but one of the necessary plus and minus strains.

Baudet (E. A. R. F.). **Sur une dermatomycose du Chien produite par Microsporum (Achorion) gallinae.** [On a dermatomycosis of the Dog produced by *Microsporum* (*Achorion*) *gallinae*.]—*Ann. Parasit. hum. comp.*, xvii (*1939–40*), 5, pp. 443–446, 2 pl., [? 1940].

From a sore on the head of a laboratory dog isolated for two months previously in a disused fowl-house the author isolated a fungus the appearance of which agreed perfectly with *Achorion* (*Microsporon*) *gallinae* [*R.A.M.*, x, p. 243; xiv, p. 101]. In culture the fungus formed downy, snow-white, later pink to reddish colonies which after a fortnight showed cracks. On beer wort agar fertile, branched hyphae developed, bearing piriform aleuria with a truncated base. Multiseptate spindle-shaped spores were observed. Experimental inoculations gave positive results on three out of three guinea-pigs, but negative results on three dogs, while on two out of two fowls they produced a whiteness of the comb, from which a fungus giving pink to reddish cultures closely resembling those of *A. gallinae* was reisolated.

McCrea (Adelia). **Studies of dermatophytic fungi with reference to the susceptibility of Guinea Pigs.**—*Pap. Mich. Acad. Sci.*, xxiv (*1938*), pp. 57–61, 1939.

In the writer's experiments at the Parke, Davis and Company Laboratories, Detroit, Michigan, guinea-pigs weighing 200 to 300 gm. were found to be definitely susceptible to infection by dermatophytic fungi of the genera *Trichophyton*, *Epidermophyton*, *Achorion*, and *Microsporon*, the period of optimum infection persisting sufficiently long for most experimental purposes [cf. *R.A.M.*, xviii, p. 177]. The maximum skin reaction is obtained with an extract of the causal agent of the lesions, but extracts of other species, or even of different genera, produce definite responses which complicate diagnosis. Reactions in 'normal' animals are attributed either to previous infection or to the presence of a dormant organism.

Reyer (W.). **Infektionsversuche mit Blastozystis.** [Inoculation experiments with *Blastocystis*.]—*Zbl. Bakt.*, Abt. 1 (*Orig.*), cxliv, 7–8, pp. 421–425, 1939.

Continuing his studies at the Hamburg Institute of Naval and Tropical Diseases on the specific identity of the different types of *Blastocystis* parasitizing man [*B. hominis*] and animals [*R.A.M.*, xviii, p 676; cf. also xix, p. 151], the writer inoculated dogs, rats, and white mice with strains of the fungus from rats and man. The organisms were found to lose both their infectivity and their characteristic morphological features very rapidly in culture. The human blastocysts were not transmissible to dogs and rats, nor those of rats to mice, except in one or two doubtful instances which do not invalidate the general conclusion that different species of the fungus are concerned in the infection of man and the various susceptible animals.

Moore (M.) & Mapother (P.). **Chromomycosis of the face : report of a case and a study of the causative organism, Phialophora verrucosa.**—*Arch. Derm. Syph., Chicago*, xli, 1, pp. 42–54, 4 figs., 1939.

The case of a 67-year-old man suffering for about ten years from facial chromomycosis due to *Phialophora verrucosa* [*R.A.M.*, xviii, p. 28] is presented in detail, and considered to be of unusual interest both as the first recorded instance of the face as a primary site of infection (following trauma from a burn), and from the fact that the disease was acquired in Missouri, the patient having never left the State.

The lesion grossly simulated blastomycosis or tuberculosis verrucosa cutis. The strain of *P. verrucosa* isolated was identical in its microscopic features with the forms previously described from Boston, Texas, and Uruguay, but differed from them to some extent macroscopically. On Czapek's agar (on which the most rapid growth was made) the colonies, blue-black to ochraceous-brown at the periphery and rat-grey in the button-shaped centre, attained a diameter of 4·3 cm. in 22 days. The glycerine agar cultures were highly distinctive, being definitely raised above the surface of the substratum and of an intense black colour, with dark grey aerial hyphae. On dextrose, maltose, and potato dextrose agar the colonies were of various shades of slate- to olivaceous-grey and on yeast-dextrose agar they were black with a dark grey centre. The Texas strain of *P. verrucosa* was characterized by extremely slow growth, its diameter in 20 days being only one-fifth that of the other cultures.

Briceño-Iragorry (L.). **Sobre cromoblastomicosis.** [On chromoblastomycosis.]—*Rev. 'Clinica Louis Razetti'*, i, 2, pp. 108–128, 13 figs., 1939. [Abs. in *Trop. Dis. Bull.*, xxxvii, 2, pp. 106–107, 1940.]

Following a short introductory history of chromoblastomycosis since its original description some 25 years ago, the author gives an account of a case of the disease in a 46-year-old negro at Caracas, Venezuela, characterized by verrucose, ulcerating lesions on the legs. On Sabourand's medium a fungus slowly developed, the macroscopic and microscopic features of which, together with the results of animal inoculations, led to its identification as *Hormodendrum pedrosoi* [*R.A.M.*, xvii, p. 747].

The author proposes the establishment of a new genus, *Carrionia*, to embrace organisms developing all three forms of fruit bodies (viz., *Hormodendron*, *Acrotheca*, and *Phialophora* types), typified in the present instance by *C. pedrosoi*.

YAMAMURA (T.). **Ein Sektionsbefund von Haut- und Eingeweideblastomykose.** [A report on the post-mortem in a case of cutaneous and intestinal blastomycosis.]—*Hihu-to-Hitunyo, Hukuoka*, vii, pp. 112–117, 1939. [Abs. in *Zbl. Bakt.*, Abt. 1 (*Ref.*), cxxxv, 23–24, p. 525, 1940.]

A yeast-like fungus isolated at a post-mortem examination from the skin, and lungs and other internal organs of a 65-year-old woman at Kumamoto, Japan, formed on a sugar-containing agar medium brownish, glistening, disk-shaped colonies. Septate mycelia were produced by budding, and chlamydospores and conidial chains were frequent, but no asci were observed. Glucose, galactose, saccharose, lactose, and inulin in peptone solutions were not fermented. Intraperitoneal inoculations into mice gave negative results. The organism is considered to be closely related to, but not absolutely identical with, *Coccidioides immitis* [*R.A.M.*, xix, p. 219].

LANGERON (M.) & GUERRA (P.). **Valeur et nature des variations et dissociations de colonies chez les champignons levuriformes.** [Value and nature of colony variations and dissociations in yeast-like fungi.]—*Ann. Parasit. hum. comp.*, xvii (*1939–40*), 5, pp. 447–469, 3 pl., [? 1940].

Observations made over a period of ten years on numerous strains of the 16 species of *Candida* previously studied [*R.A.M.*, xviii, p. 253] showed that in *Candida* the smooth, creamy type of colony alternates with the folded, membranous, rugose type, these types corresponding, respectively, with the S and R colonies of bacteria [ibid., xv, pp. 152, 502; xvii, p. 527; xviii, p. 526]. Mixed colonies may occur, as in the case of *C. albicans* and *C. tropicalis*, while some strains never change from the creamy type. The two phases are reversible, reversion being induced simply by a change in the reaction of the medium. The membranous R phase is characterized microscopically by (*a*) a pseudomycelium (formed by budding) which is strongly developed, often with coremia, and a reduction in the number of blastospores; (*b*) pleurogenous pseudoconidia, which in certain species, e.g., *C. tropicalis*, are able to form long, branching chains; and (*c*) non-septate filaments formed by pseudo-germination of the blastospores, pseudoconidia, and even portions of the pseudomycelium. The creamy S phase shows only free, yeast-like elements, with a few faint traces of pseudomycelium.

The S phase is the normal one. The R phase develops as a result of various factors, chiefly the reaction of the medium and 'elongation factors' (i.e., presence of carbon dioxide, nutrients with a high molecular weight, and nitrates). Some of these factors appear spontaneously in cultures three or four months old, and variation in such factors suffices to control and explain the alternation of the two phases and the slowness of the process. The R phase is always accompanied by the appearance of a veil in liquid media containing sugar. During the

passage from one phase to the other no important modifications occur in the zymogram or auxanograms of nitrogen and sugars.

It is concluded that there is no true dissociation in *Candida*, as the phases are always reversible. As there is no fundamental difference between the alleged dissociation of the yeasts and that of bacteria it becomes very doubtful whether there is any such thing as dissociation.

Burt (K. L.) & Ketchum (Helen M.). **The classification of strains of Monilia isolated from sputum.**—Abs. in *J. Bact.*, xxxix, 1, pp. 15–16, 1940.

Of 180 cultures of *Monilia* [*Candida*] isolated on glucose agar from the sputum of 174 out of 500 patients at the Michigan State Sanatorium, 146 were identified as *C. albicans* [*R.A.M.*, xix, p. 217], 32 as *M. candida* [*C. vulgaris*: ibid., xix, p. 18], and 2 as *C. krusei* [loc. cit.]. Fermentation tests were successfully conducted in modified Durham tubes containing Pfanstiehl maltose and sucrose. Twenty of the patients who were negative for tubercle bacilli by culture yielded *C. albicans* and one *C. vulgaris*.

Grigoraki (L.) & David (R.). **Caractères bio-chimiques de Microsporum gypseum (Bodin, 1907). Caractères bio-chimiques de Microsporum fulvum (Uriburu, 1907).** [Biochemical characters of *Microsporum gypseum* (Bodin, 1907). Biochemical characters of *Microsporum fulvum* (Uriburu, 1907).]—*C.R. Soc. Biol., Paris*, cxxxii, 25, pp. 448–452, 1939.

Achorion (*Microsporon*) *gypseum* [*R.A.M.*, xviii, p. 523; xix, p. 92] being liable to confusion with *M. fulvum* [ibid., xviii, p. 523 and next abstract] by reason of the morphological similarities of the two species, the biochemical characters of the fungi were studied with the object of facilitating their differentiation. Casease and trypsin both developed slowly and acted feebly in cultures of *A. gypseum*, there was little change of colour in carbohydrate solutions, and no appreciable production of indol. In the case of *M. fulvum*, casease was very active, peptonizing 10 c.c. milk in a month, and trypsin comparatively so, developing in 20 days and liquefying the gelatine (18 per cent.) in the cultures in a further ten. The colours [Klincksieck and Valette's standard] of saccharose, lactose, maltose, glucose, mannose, and galactose solutions ranged through purple-red 556 to purple-red 581, purple 531 to red 16, purple 531 to red 26, purple-red 586 to red-orange 86, red 16 to red-orange 61, and red 3D to red-orange 76, respectively, in a 30-day period. Tests for indol gave negative reactions.

Kingery (L. B.), Williams (R. J.), & Kidd (H. A.). **Influence of age on ringworm infection of the scalp : an experimental study.**—*Arch. Derm. Syph., Chicago*, xl, 6, pp. 879–886, 2 figs., 1939.

On a carefully selected nutrient medium [the composition of which is indicated], *Microsporon audouini* and *M. fulvum* [see preceding abstract] made more abundant growth in the presence of extracts (2·5 to 15 mg.) of preadolescent (five and ten years) than of mature (over 25) hair. The actual weights after desiccation ranged from 0·0013 to 0·0026 and 0·0008 to 0·0024 gm. for *M. audouini* on five- and ten-year-old hair, respectively, the corresponding figures for *M. fulvum* being

0·0067 to 0·0087 and 0·0064 to 0·0085 gm., respectively, while the amount of growth made in all the flasks containing mature hair was too small for weighing; the same was true of the controls (no hair) in the case of *M. audouini*, while *M. fulvum* was able to develop to the extent of 0·005 gm.

The infrequency of ringworm in adults is a matter of common observation. The results of these experiments may be interpreted either by the presence in young hair of nutritional substances or by that in older material of inhibitive or toxic elements.

STRAIB (W.). **Zum epidemischen Auftreten des Leinrostes in Ostpreußen.** [On the epidemic occurrence of Flax rust in East Prussia.]—*NachrBl. dtsch. PflSchDienst*, xix, 6, pp. 49–51, 1939. [Abs. in *Zbl. Bakt.*, Abt. 2, ci, 21–22, p. 423, 1940.]

Prior to 1937 *Melampsora lini* was of rare occurrence on flax in Germany, but in 1938 an exceptionally severe outbreak was reported from East Prussia. The author has established the existence of eight physiologic races of the rust [*R.A.M.*, xviii, p. 679]. Having regard to the risk of transmission of infection by means of the seed and stem fragments, the exclusive use of home-grown seed is recommended to avoid the introduction of new and aggressive races. The possibilities of checking the spread of the disease by seed treatment should also be explored. In localities threatened by rust epidemics it is advisable to sow the flax crop early enough for the harvest to precede the development of conditions favouring the growth of the pathogen.

RÖDER (K.). **Über einen neuen Hanfschädiger, Didymella arcuata n.sp. und seine Nebenfruchtformen.** [On a new Hemp pathogen, *Didymella arcuata* n.sp., and its imperfect stages.]—*Phytopath. Z.*, xii, 4, pp. 321–333, 7 figs., 1 graph, 1939.

Hemp in the vicinity of Berlin was observed to be attacked by a fungus causing a brown to whitish spotting of the leaves, with individual lesions up to 1·5 cm. in diameter, accompanied by severe stunting, diseased plants being 20 to 30 cm. shorter than healthy ones at the period of maximum infection (mid-June). From the necrotic foliar tissues the writer isolated in pure culture on standard media both the perithecia of an Ascomycete, *Didymella arcuata* n.sp. [with a Latin diagnosis], and the pycnidia of *Ascochyta cannabina*, together with a few chlamydospores. The brownish-black, globose to slightly depressed perithecia measure 100 to 150 (mean 130) μ in diameter; the elongated to subclavate asci, 57 to 60 by 10 to 13 (58 by 12, range 50 to 80 by 9 to 14) μ, are interspersed with non- to few-septate paraphyses, 23 to 60 by 0·5 to 1·5 (35 by 0·9) μ, and contain eight uniseptate, hyaline, mostly biseriate ascospores, 18 to 19 by 4·5 to 5·2 (18·6 by 5; range 16 to 22 by 4 to 6) μ; the dark brown, circular, rarely elongated to reniform pycnidia measure 100 to 150 (135) μ, occasionally up to 200 by 120 μ and contain mostly uniseptate, hyaline, elongated to oval, straight or slightly curved spores, 17 to 20 by 5·3 to 6·3 (18·5 by 5·8; range 13 to 25 by 3·5 to 8) μ, and a few biseptate, 22 to 28 by 5 to 8 (25 by 6·7) μ, borne on continuous, papilliform or columnar sporophores, 5 to 13 by 2 to 7 (9 by 4) μ; the intercalary, brown, smooth, circular

to oval, thick-walled chlamydospores measure 10 to 12 μ singly or 8 to 9 by 8 μ in short chains.

The examination of herbarium material of *A. cannabis* Lasch and *A. cannabis* (Speg.) Vogl., originally isolated from hemp in Germany and Italy, respectively, showed the former to be a valid species for which the name *Septoria cannabis* (Lasch) Sacc. [*R.A.M.*, xvi, p. 749] is not accepted. On the other hand, *A. cannabis* (Speg.) Vogl. revealed close affinities with *Phyllosticta cannabis* (Kirchner?) Speg. [ibid., xvii, pp. 180, 587] to which it is accordingly referred.

The optimum temperature for spore germination and growth in *D. arcuata* on potato juice agar was found to lie between 19° and 26° C., the minimum and maximum being 6° and 31°, respectively (after six hours). Daylight promoted reproductive and darkness vegetative development. The mycelium was white at first, changing to olive—later very dark green or sepia, with tints of varying shades of red and after several days of purple or isabelline, and a narrow, white strip at the edge of the growth zone.

Black (L. M.). **Mechanical transmission of Aster-yellows virus to leaf hoppers.**—Abs. in *Phytopathology*, xxx, 1, pp. 2–3, 1939.

The aster [*Callistephus chinensis*] yellows virus [*R.A.M.*, xix, p. 22] was mechanically transferred from viruliferous to non-viruliferous aster leafhoppers (*Macrosteles divisus*) at 0° C. Dilutions of juices from macerated viruliferous leafhoppers as high as 1 in 100 in 0·85 per cent. sodium chloride solutions were found to be infectious on injection into non-viruliferous insects through capillary glass tubes, up to 40 per cent. of the inoculated leafhoppers becoming infective for plants after incubation periods of two to six weeks. Mechanically inoculated insects are apparently quite as capable of transmitting the yellows virus to healthy asters as those that acquire the infective principle from feeding on diseased plants. When non-viruliferous leafhoppers, after feeding for two days on infected asters, were maintained on rye (immune from yellows), no virus could be detected in such insects at first but later juice from them, injected into non-viruliferous individuals, proved infectious at dilutions up to 1 in 100. This is considered to establish the multiplication of the virus in its insect vector.

Dunegan (J. C.). **A blight of wild Cherry seedlings.**—*Phytopathology*, xxx, 1, pp. 89–90, 1 fig., 1940.

Each spring since 1924 *Sclerotinia seaveri* has been observed causing a blight of wild cherry (*Prunus serotina*) seedlings in Georgia and Arkansas, commencing about the time of unfolding of the second pair of true leaves. The development of a brown, water-soaked area near the stem apex is accompanied by a loss of turgor, the infected seedlings being readily distinguishable by a characteristic drooping of the affected portion. The pathogen spreads down the stem, killing the plants on its arrival at soil level.

Crawford (R. F.). **The causes and control of chlorosis in New Mexico.**—*Bull. N. Mex. agric. Exp. Sta.* 264, 12 pp., 3 figs., 1939. [Abs. in *Exp. Sta. Rec.*, lxxxii, 2, p. 202, 1940.]

Foremost among the causes of chlorosis of ornamentals and fruit and

forest trees in New Mexico are stated to be fungal and virus diseases, stomatal obstruction by dust, subnormal early spring temperatures after coming into leaf, lack or non-availability of essential mineral nutrients, excess water, oxygen and nitrogen deficiency in the soil, and insufficient light. The form of the trouble due to mineral deficiency or non-availability, believed to be the most important of the factors listed, may be temporarily combated by the application to the soil, by sprays or injections, of iron salts [cf. *R.A.M.*, xv, pp. 229, 758, *et passim*], while the most effective permanent treatment consisted in the incorporation of farmyard manure with the addition of iron and aluminium sulphates (1 : 1) at the rate of 1 lb. of the mixture for each inch of diameter of the plant; an acid solution of these sulphates gave good control of chlorosis in American vines and other plants.

Schultz (H.). **Untersuchungen über die Rolle von Pythium-Arten als Erreger der Fusskrankheit der Lupine. I.** [Investigations on the role of *Pythium* species as agents of Lupin foot rot. I.]—*Phytopath. Z.*, xii, 4, pp. 405–420, 5 figs., 2 graphs, 1939.

Previous studies having shown the prevalence of *Pythium* spp. in most of the soils in Germany where lupins suffer from foot rot, further investigations were made in 1938 at the Biological Institute, Dahlem, Berlin, to determine the part played by these organisms in the causation of the disease.

Out of 63 plants examined, 37 yielded *Pythium* (33 *Lupinus angustifolius* and two each of *L. luteus* and *L. albus*), other fungi encountered including *Rhizoctonia*, *Fusarium*, and *Botrytis*. For comparative purposes 41 other strains of *Pythium* from lupins, seven from hemp, apple, cucumber, lucerne, and tomato, and herbarium material of eight species from Baarn were available. On the basis of morphological and physiological characters, 37 of the strains fall into group A (*Pythium de Baryanum*) [*R.A.M.*, vi, p. 731; xviii, p. 832], characterized by a smooth or curved mycelium; globular or oval, terminal or intercalary, rarely lateral sporangia, 9·6 to 28·5 (mean 15 to 21·9) μ; similar oogonia; smooth, globular oospores, 12 to 25·5 (17 to 21·2) μ; by most profuse fructifications on Congo red agar and sterility on malt-peptone; by no growth on 0·01 per cent. malachite green; and by minimum, optimum, and maximum temperature requirements of 5° to 6°, 25° to 30°, and 35° C. Group B (*P. intermedium*) [ibid., xvi, p. 813] was represented by two strains (115 and 165), characterized by concatenate, globular, terminal, or intercalary sporangia, 14·3 to 21 (17) μ in 115, 9·9 to 17·6 (14·4) μ in 165. Sporangial production on Congo red and malt-peptone agars was sparse and very sparse, respectively; no oogonia or oospores were formed; good growth and dehydrase activity took place on 0·01 per cent. malachite green and the minimum, optimum, and maximum growth temperatures were 3° to 6°, 25°, and 32° to 33°, respectively. Two strains (35 and 155) temporarily referred to *P. vexans* (group C), though relationships with *P. allantocladon*, *P. ascophallon*, and *P. diameson* [ibid., xi, p. 546] are also indicated, are characterized by globular, oval, or irregular, terminal, intercalary, or lateral sporangia, 14·8 to 22 (18·75) μ in 35, 14·7 to 20·8 (17·23) μ in 155; oogonia and oospores smooth and globular, the latter filling the former completely or nearly

so and measuring (35) 12·7 to 18·8 (15·6) μ and (155) 13·8 to 17·6 (15·44) μ; sparse sporangial production on Congo red, none on malt-peptone; good growth and dehydrase activity on 0·01 per cent. malachite green; minimum, optimum, and maximum temperatures for 35, 5° to 6°, 25°, and 32° to 33°, and for 155, 5°, 25° to 30°, and 35°, respectively. Finally, one strain (178) is referred to *P. diameson* (group D), with globular or oval, terminal, rarely intercalary sporangia, 10·2 to 17·2 (14·5) μ; smooth, globular oospores entirely filling the oogonia of similar shape and consistency, 12 to 16 (13·68) μ; isolated sporangia and oospores on Congo red, sporangia only on malt-peptone; no growth on 0·01 per cent. malachite green; minimum, optimum, and maximum temperatures 6°, 20° to 25°, and 35°, respectively. The 37 strains of group A were isolated from *L. angustifolius* (27), *L. angustifolius* 'sweet lupin' S.E.G. (6), *L. luteus* (2), and hemp (2). *P. intermedium* (B) originated in *L. angustifolius* and an apple seedling, *P. vexans* (C) in *L. albus* and lucerne, and *P. diameson* (D) in 'sweet lupin'.

Department of Scientific and Industrial Research. Report of the Food Investigation Board for the year 1938.—277 pp., 2 pl., 2 figs., 5 diags., 88 graphs, 1939. [Issued January, 1940.]

This report [*R.A.M.*, xvii, p. 794] contains the following items of phytopathological interest. In experiments by F. Kidd and C. West (pp. 143–148) Cox's Orange Pippin apples from trees receiving no potash fertilizer developed fungal wastage [unspecified] sooner and more intensively (average percentage, 41·2) when stored at the optimum temperature 39° F. than those from trees supplied with potash (19·7). On the other hand, the presence of potash rendered the fruit more liable to low-temperature breakdown at 34°, though this result is of academic interest only since commercial storage of this variety is carried out at 38° to 39°.

In further experiments by A. S. Horne and R. G. Tomkins (pp. 171–173) on the relation between resistance, mortality, and spore load in Bramley's Seedling apples from three different localities, 50 per cent. wastage was observed after 80, 100, and 126 days in samples from Kent, the West of England, and the Fen district, respectively, to which spores of *Phomopsis malorum* had been added, and after 95, 118, and 122 days in the untreated samples. Wastage in samples to which *P. malorum* had been added was greater, but not significantly so, than in untreated samples from the same district. Susceptibility to attack by *Cytosporina ludibunda* was greatest in apples (Bramley's Seedling) from the Fens, followed in order by those from the west of England and Kent.

In trials by A. S. Horne and W. A. Roach (pp. 177–183) on the resistance of apple fruits to *C. ludibunda* in relation to the injection of the trees with solutions of fertilizers, inoculated Bramley's Seedling apples from trees injected with solutions containing nitrogen showed an increased susceptibility, particularly those injected in their 'off' year. On the other hand, injection of Boscombe's Mystery apple trees with solutions containing nitrogen induced resistance in the fruit, ammonium nitrate producing the most striking effect, followed by urea and asparagin. Fruit from Bramley's Seedling trees injected with

glucose showed a relative high resistance during early storage, but this was not maintained later.

In further experiments by A. S. Horne and J. Colhoun (pp. 173–177) on the resistance of apples (Bramley's Seedling) to fungal invasion in relation to locality, the average penetration of *Penicillium* through the lenticels was 97·6 per cent. for the fruit from Kent and 82·1 for that from Ulster, the corresponding percentages for *Botrytis* being 69·0 and 36·9, respectively. Following inoculation of the lenticels the *P.* spots developed more quickly on both Kent and Ulster fruit than in the previous year, whereas with *B.* the spots developed later in the Kent fruit and earlier in that from Ulster. Inoculation made through punctures resulted in the development of *P.* spots in every case within 3 to 10 days; *B.* spots developed in all the fruit from Kent within 3 to 24 days, but in the case of the Ulster samples only in 87·3 per cent. of punctures did spots develop within 4 to 41 days. The averages of radial advance for November and February were 1·091 and 2·499 mm. per day, respectively, for Kent, and 0·285 and 2·075 mm. respectively, for Ulster. The averages for natural spotting in January and February were 4·4 and 27·2, respectively, for Ulster, and 27·8 and 31·0, respectively, for Kent.

F. Kidd and C. West (pp. 157–160) found that the storage life of Doyenne du Comice pears in gas storage is shorter than that of other varieties owing to the development of brown heart, which occurred after 97 and 150 days at temperatures of 34° and 31·5°, respectively. The incidence of brown heart is apparently related to the degree of maturity of the fruit when placed in gas storage.

The results obtained by W. H. Smith (pp. 148–153) with storage of Monarch plums have already been noticed from another source [ibid., xix, p. 105].

The same worker's (pp. 161–165) investigations on the gas storage of Monarch plums showed that at all temperatures tested (31°, 37°, and 45°) the incidence of physiological breakdown was lower in samples stored in gas mixtures 5 (composed of 5 per cent. oxygen, 2·5 per cent. carbon dioxide, and 92·5 per cent. nitrogen) and 6 (5 per cent. oxygen and 95 per cent. nitrogen, though 0·1 to 0·2 per cent. carbon dioxide accumulated owing to respiratory activity of the fruit), than in the control samples stored in air, the reduction being greatest in mixture 5; in mixtures 4 and 3 (the first composed of 16, 5, and 79, and the second of 18·5, 2·5, and 79 per cent. of oxygen, carbon dioxide, and nitrogen, respectively), there was an increase in physiological breakdown at 31° and 37°, but a slight reduction at 45°. It thus appears that a decrease in physiological breakdown occurs when, in the presence of small percentages of carbon dioxide, the concentration of oxygen is reduced to 5 per cent. There was generally some decrease in the amount of fungal rotting [unspecified] in the samples stored in the gas mixtures as compared with those stored in air.

The following results were obtained by C. R. Furlong and J. Barker (pp. 169–171) in small scale storage trials with Palestine grapefruit upon its arrival in England. At 65° slight brown pitting developed at the beginning of the storage period on a small proportion of the early-, middle-, and late-season fruit, but did not increase with prolonged

storage; after about 40 days all the fruit was wilted and unsuitable for commercial purposes. At 45° slight brown pitting developed on a few fruits of some of the early, middle, and late samples, but did not increase, while in other samples some fruits developed a spotting described as low temperature injury, which increased with prolonged storage. At 34° all the samples developed a form of low temperature injury, beginning with superficial browning of the skin between the oil cells, followed by the collapse of the latter and the development of numerous chocolate-brown spots, which enlarged slowly but did not coalesce. Generally the late-season fruit was more resistant to injury than the middle- and early-season, the last-named being the least resistant of all.

R. G. Tomkins (pp. 184–186) in continuation of his experiments on wastage in Jaffa oranges [cf. ibid., xix, p. 88] caused by *P. digitatum*, showed that storage in a saturated atmosphere under restricted ventilation, allowing for an accumulation of carbon dioxide up to 10 per cent., did not increase wastage, as compared with storage in a saturated atmosphere free from carbon dioxide. Wastage was greater in the early-season (November) fruit than in the later-season (March and May) samples. In trials with storage temperatures of 18°, 10°, and 5° C., the times taken for 10 per cent. wastage were 16, 45, and 55 days, respectively, for untreated fruit stored in March, and 12, 27, and 61 days, respectively, for that stored in May, the corresponding figures for fruit sprayed with spores of *P. digitatum* being 10, 30, and 43, and 7, 20, and 56 days, respectively; these data indicate that fruit stored in May was more susceptible than that stored in March. Greater wastage occurred in the fruit sprayed with spores than in untreated fruit. The increase in wastage due to the addition of spores was not the same at different temperatures, possibly owing to the effect of temperature on susceptibility to infection. The reduction of the storage temperature from 18° to 10° delayed the onset of rotting and decreased its rate of progress, while the reduction from 10° to 5° delayed the onset but did not influence the subsequent rate of decay. Storage at 5° for long periods caused some injury which increased susceptibility to rotting.

In experiments by the same author (pp. 186–189) on the use of treated wraps to prevent fungal rotting, the amount of wastage developing in storage at 18°, 10°, or 5° in oranges wrapped in wraps impregnated with o-phenylphenol (0·1 gm.) [cf. ibid., xix, p. 211] and either benzidine or hexamine (0·1 gm.) was considerably reduced (e.g., to 14 and 45 per cent. at 18°) as compared with those in untreated wraps (64 and 70 per cent. at 18°). Wraps treated with either of these two combinations are practically odourless. The relative amounts of o-phenylphenol and hexamine can be varied within wide limits, the most suitable proportion being about 35 parts of hexamine to 170 parts of o-phenylphenol. The total amounts of substances used can also be varied within wide limits without altering their retarding effect on rotting. Wraps treated with o-phenylphenol and hexamine were found to cause some injury to apples and bananas, but not to tomatoes and grapes.

J. C. Fidler and R. G. Tomkins (pp. 189–190) found that the addition of spreaders did not increase the effectiveness of borax in reducing green mould [*P. digitatum*: ibid., xviii, p. 246] in citrus fruits. Solutions of 1 per cent. borax plus 1 per cent. sodium hydroxide were as effective

as 5 per cent. borax. Dipping oranges in 2 per cent. sodium hydroxide reduced green mould as effectively as immersion in 5 per cent. borax and caused less injury to the skin.

Report of the Low Temperature Research Laboratory, Capetown, 1937–1938.—275 pp., 43 figs., 5 diags., 56 graphs, 1939.

This report [*R.A.M.*, xviii, p. 804] includes results of the following investigations. R. Davies, W. W. Boyes, and D. J. R. De Villiers (pp. 13–28) state that traces of internal breakdown occurred in 36 per cent. of one consignment of very ripe Santa Rosa plums [loc. cit.] stored for 25 days at 45° or 48° F. and then removed for ripening at 45°, a storage temperature of 48° being apparently safer for the most mature fruit. Kelsey plums stored at 34°, 45°, or 48° for 24 to 25 days and then ripened at 48° developed internal breakdown at all these storage temperatures, the defect being most severe at 34° and least so at 48°. This severe incidence of internal breakdown at all storage temperatures is stated to indicate a seasonal effect. Severe pitting and abnormal softening of the surface tissues (of unknown origin) occurred in Kelsey plums stored at 45° and 48° and is considered to be a major factor in their storage. Wickson plums stored at 45° and 48° developed severe breakdown which showed a tendency to decrease with increased maturity.

The same authors (pp. 51–53) found that Peregrine peaches of commercial maturity stored for 25 days at 34° and subsequently ripened at 45° required 2·5 to 3 days pre-storage delay at 75° to eliminate all but slight traces of woolliness [loc. cit.], or 4 to 5 days at 65° to eliminate it completely, while only moderate control was obtained with 10 days' delay at 50°. Slow cooling was less satisfactory than immediate cooling after a delay of 1 to 1·5 days and taking the quality of the fruit into consideration a delay temperature of 65° is considered to have been the most suitable. Ripening the fruit at 45° resulted in the absence of 'pink flesh' [loc. cit.]. Delayed storage produced an appreciable but less striking improvement in Elberta peaches, delay at 50° being apparently most suitable for this variety.

The results of J. M. Rattray's (pp. 55–65) experiments on the storage of Honeydew melons [cf. ibid., xvii, p. 723] showed that temperatures of 45° and 50° were more favourable for the development of fungal wastage [unidentified] than those of 60°, 65°, or 70° (the storage period in all cases being 25 days followed by 20 days at 50°), the most characteristic symptoms being slow-growing, brown, depressed spots, and stem-end rots, which do not seriously affect the edibility of the fruit. At the three higher temperatures, however, species of *Rhizopus* and *Penicillium* may occur and cause the complete collapse of a large number of melons in a short time.

J. M. Rattray (pp. 65–74) presents evidence that wastage in Gros Colman grapes including that caused by *Botrytis cinerea* and *Penicillium* [ibid., xviii, p. 804; xix, p. 24], considered as total wastage or separately for the two fungi again showed a tendency to increase with maturity of fruit. Desiccation of the stem and drop-berry [ibid., xviii, p. 805] were more severe in White Hanepoot grapes stored at 29° than in those kept

at 31° or 34°, but wastage caused by *B. cinerea* was reduced to 1·5 per cent. as compared with 4·5 and 5 per cent., respectively, at the two higher temperatures (the percentage of *Penicillium* wastage was inconsiderable at all three temperatures). Rapid pre-cooling before storage at 29° resulted in severe desiccation and an increase in the amount of drop-berry, but showed only 1·7 per cent. *Botrytis* wastage as compared with 8 per cent. in grapes directly stored at 34°.

J. E. van der Plank and J. M. Rattray (pp. 74–76) used volatile diethyl chloramine and tertiary butyl hypochlorite as preservatives for grapes by placing plugs impregnated by solutions of these substances in mineral oil or non-volatile saturated esters into boxes with Gros Colman grapes (one plug to each wrapped packet) stored for 19 to 20 days at 34° and thereafter for a week at 50°. Subsequent examination showed that *Botrytis* waste was reduced from 30·7 per cent. in the untreated control to 1·4, 3·2, and 2·5 per cent. in packets treated a day before cooling with 0·4, 0·2, and 0·1 c.c. of tertiary butyl hypochlorite in oil, respectively, and to 7·4, 4·0, 4·4, and 6·5 per cent. in packets treated with 0·2 c.c. tertiary butyl hypochlorite and 0·8 c.c. triacetin, the former and 0·8 c.c. ethylene glycol diacetate, 0·35 c.c. diethyl chloramine and 0·65 c.c. triacetin, and 0·18 c.c. diethyl chloramine and 0·82 c.c. triacetin, respectively, and cooled immediately. When one large plug treated with 2·0 c.c. tertiary butyl hypochlorite and 8 c.c. oil was placed in the centre of each box directly before cooling the percentage of *Botrytis* waste was reduced to 8·8 from 29·8 per cent. in the untreated control.

J. E. van der Plank (pp. 76–78) discusses various methods of fumigating grapes against *Botrytis* rot and suggests the use of a mixture of finely powdered dehydrated potash alum and anhydrous sodium bisulphite which gives off sulphur dioxide (the only gaseous disinfectant permitted by the British Public Health Regulations) when exposed to the humid atmosphere inside a box of fruit. The output of sulphur dioxide can be controlled by regulating the intake of water vapour by enclosing the mixture in packets of varying permeability to water vapour, using smaller-sized packets and thus reducing the water-absorbing surface, or including within the packet a hygroscopic substance, such as an excess of dehydrated alum, capable of temporarily withholding water from the hydrolytic reaction. [Details of the packets and the quantities of the chemicals used are tabulated.]

In confirmation of previous conclusions regarding the drop-berry problem of grapes in storage [loc. cit.], E. Beyers (pp. 79–87) obtained further evidence that the incidence of drop and rate of desiccation of stalks of Waltham Cross grapes from Paarl were directly affected by the prevailing temperature during picking and packing and the degree of delay before cooling commences. Thus, picking under cooler conditions early in the morning ensured a better general keeping quality and gave rise to only 3·5 per cent. of drop-berries as compared with 5·8 in the afternoon pickings. Prompt cooling checked both drop and desiccation of stalks as well as the incidence of mould wastage (*B. cinerea*) and enhanced the freshness of the berries, while the opposite effects resulted from delayed storage and high temperatures during the marketing period. The results of irrigation experiments showed no material

improvement in drop, but less extensive desiccation of stalks for the irrigated plots. Grapes picked at an advanced stage of maturity showed a reduction in the amount of drop after storage, but were at the same time considerably more affected by wastage and more desiccated than at the green stages.

In storage tests with apples, W. E. Isaac and W. W. Boyes (pp. 117–126) found that at storage temperatures of 31°, 34°, and 37° superficial scald was reduced or eliminated by oil wrappers in Rome Beauty apples without inducing any undesirable effects, and reduced but not eliminated in the Wemmershoek variety, for which oil wrappers were less effective at 31° than at 34° or 37°. Wemmershoek apples wrapped in oil wrappers showed in most cases a higher percentage of bitter pit, reaching a maximum of 29 per cent. as compared with 13 per cent. in those wrapped in sulphite wrappers. Immediately on removal from cold store superficial scald was absent or rarely exceeded 5 per cent. in Wemmershoek apples but increased with decreasing storage temperatures after one week at 65°. Rome Beauty apples showed two types of superficial scald, viz., the ordinary and the 'spotting' type. The latter occurred chiefly on apples stored at 37°, and was more abundant at 34° than at 31°. Immediately after withdrawal from store the percentage of scalded Rome Beauty apples could be directly correlated with storage temperature, but after a week at 65° the differences in the amount of scald (except for the 'spotting' type) in apples stored at the three temperatures had largely disappeared.

The results of storage experiments with Navel oranges conducted by J. E. van der Plank, J. M. Rattray, W. W. Boyes, and D. R. J. de Villiers (pp. 126–142) showed that fruits from Cape Province stored at 40° and 50° exhibit a relatively low correlation between waste and temperature, while those from the Transvaal stored at 35°, 40°, 45°, 50°, and 55° were either little affected by temperature or adversely influenced by warmer temperatures. An examination of fruits from all temperatures showed that of a total of 4,166 infected, 3,840 (92 per cent.) were infected by green mould (*P. digitatum*) and only 78 by blue mould (*P. italicum*). The former usually enters the fruit at the stem end, possibly on account of the inherent weakness of this part of the orange, or because of the presence of clipper wounds in this region. An elimination of green mould infections of the stem end would, it is estimated, reduce the total waste in oranges to almost a third. *Alternaria* and *Colletotrichum* appeared to be the most common parasites in the group of stem end and lateral rots, which were encountered in a total of 181 fruits, or 4·3 per cent. of the total number of wasty fruits, there being an average for all consignments of 0·19 per cent. for fruit stored at 40° and 0·46 per cent. at 50°. Button browning [ibid., xviii, p. 805] occurred to a serious extent (69·1 per cent.) in a consignment from Groot Drakenstein and to a slight degree (1·4 per cent.) in one from Sundays River; the disease was greatly reduced or eliminated by storage at 50° instead of 40°.

J. E. van der Plank and J. M. Rattray (pp. 142–145) report that wraps impregnated with ortho-phenylphenol [see preceding abstract] reduced the *Penicillium* decay in stored oranges from 5 per cent. in the control to 1·5 and 2·9 per cent. in the fruit from Mataffin and from

3·2 to 0·8 per cent. in that from Rustenburg, but severe scalding of the rind occurred at all strengths used (2·4 to 4·5 gm. per 100 sq. ft. of paper).

J. E. VAN DER PLANK (pp. 145–155) tabulates evidence to show that Marsh grapefruit picked from the outside of the tree were consistently the most susceptible to cold injury in storage. In fruits stored at 40° for short periods (three to four weeks) delayed storage at 80° was generally beneficial and in those stored for long periods usually ineffectual, irrespective of the length of postponement, while in those stored for intermediate periods short delays of one to two days were most beneficial and long ones dangerous. In fruit stored at 40° or 45° without delay cold injury mostly developed during the first four to five weeks and thereafter increased very slowly, while retarded storage reduced this primary susceptibility but increased the subsequent development of injury.

Data on lemon storage [cf. ibid., xviii, pp. 437, 673] from three different growers presented by J. E. VAN DER PLANK, J. M. RATTRAY, P. A. CROUS, and J. KRIEL (pp. 156–169) are held to indicate that fruits stored for about four weeks at temperatures from 40° to 55° show least waste (mostly *P. digitatum*) when picked at a green stage, the average figures for all temperatures being 13·1 per cent. for the riper as against 1·7 per cent. for the greener stage immediately upon removal from storage, and 33·9 compared with 6·8 per cent. after a further fortnight at 65°. Green fruit appeared somewhat more susceptible to red blotch (adustiosis) [ibid., xvii, p. 390] and membranosis [ibid., xvii, p. 389] than the riper.

J. M. RATTRAY (pp. 170–176) tried a number of disinfectants for the control of green mould of oranges (*P. digitatum*), the inoculated fruit being held for 24 hours at 65° previous to dipping, and after the treatment air-dried, wrapped, and stored at 55°. Cold solutions of Wyandotte steri-chlor (containing 16 per cent. sodium para-toluenesulphonchloramide) gave poor results except for very long immersions, but by increasing the temperature of the solution the time of immersion can apparently be shortened and the concentration of the fungicide reduced. In preliminary experiments complete control was obtained with hot solutions (at 107° to 110°) of the fungicide in concentrations of 0·625, 1·25, and 2·5 per cent. There was little difference in the degree of control shown by cold (58°) and hot (104° to 106°) solutions of Shirlan WS plus agral I. With a time of immersion fixed at 4 minutes, sodium orthophenylphenate (dowicide A) at 0·5 and 0·17 per cent. proved more effective than the same concentrations of sodium para-phenylphenate or 1 and 0·33 per cent. Shirlan WS; 0·1 per cent. ortho-phenylphenol was far more effective than the same concentration of either trichlorophenol or dichloro-ortho-cresol; and 0·02, 0·04, and 0·08 per cent. sodium ortho-phenylphenate were conspicuously more effective than the same concentrations of sodium 2-4-5-trichlorophenate (dowicide B), sodium chloro-ortho-phenylphenate (dowicide C), or sodium tetrachlorophenate (dowicide F). Good control (0·0 to 3·7 per cent. of wounds infected) was obtained with concentrations of sodium ortho-phenylphenate of 0·20, 0·15, and 0·10 per cent., but 0·5 per cent. at 106° to 110° was injurious to the orange, causing brown blemishes.

Beare (J. A.). **Superficial scald in Granny Smith Apples.**—*J. Dep. Agric. S. Aust.*, xliii, 5, pp. 403–405, 1939.

In South Australia most growers rely upon sweating and late picking of apples for the control of superficial scald. In control experiments during 1939 with Granny Smith apples, wrapped and unwrapped fruit was subjected to various sweating periods and subsequently stored at 32° to 34° F. The mean percentage of scald in unwrapped fruit from all sweating treatments was 7·8 in the early-picked fruit (30th March) and 47·0 in the late-picked (17th April). Sweating for one or two weeks reduced the amount of scald in late-picked fruit from 82·3 per cent. in that stored immediately to 40·5 and 18·4 per cent., respectively, whereas the corresponding figures for the early-picked were 7·6, 11·4, and 4·4 per cent.; the method is considered to be an unreliable means of control. Late-picked fruit, whether stored immediately or sweated for one or two weeks, developed mealiness sooner and was in a poorer condition after storage than early-picked fruit, particularly when that had been stored immediately. Excellent results were obtained with oiled paper, either used as wraps or shredded and placed between the layers of unwrapped fruit, the percentage of scalded fruit under these conditions being 1·3 and 3·8, respectively, as compared with 82·3 in the unwrapped fruit and 61·4 in fruit wrapped in plain sulphite wraps. It is concluded from these results that scald-susceptible varieties can be supplied to the customer in good order, if they are picked in prime condition, stored immediately, and wrapped in oiled paper.

Kemp (H. K.). **Detection of water core in Apples.**—*J. Aust. Inst. agric. Sci.*, v, 4, pp. 227–229, 1 fig., 1939.

A method is described of separating apples affected with water-core [*R.A.M.*, xix, p. 29] from normal fruits without impairing their value for storage tests. A container was constructed with three holes in the top on which three apples were placed with the stem-end downwards; under each apple was a 100-watt electric light bulb. At one end was an inlet for a forced draught from a fan and at the other a light-proof draught exit. The central hole was used for the apple under test, and the end ones were occupied by an affected and a normal apple, respectively, used as standards of comparison, and the condition of which had previously been determined by cutting. The presence of water-core was revealed by a marked increase in the light transmitted by affected apples when observed in a dark room or under a hood. Severely affected fruits assumed a bright, luminous appearance with glowing spots where the water-soaked tissue reached the surface. With slightly affected apples detection was more difficult. The method failed when slight water-core was present in a lens-shaped area in the plane of the source of light, and gave uncertain results where patchy development was present throughout the flesh, 10 to 15 per cent. of apples separated as normal showing this slight, patchy form of water-core. X-rays [cf. ibid., xix, p. 225] and ultra-violet rays did not give satisfactory results. While admittedly imperfect, the method is considered useful for its purpose; only one size of fruit should be examined at one time.

Baines (R. C.). **Pathogenicity and hosts of the fly-speck fungus of Apple.**—Abs. in *Phytopathology*, xxx, 1, p. 2, 1940.

The fly-speck fungus, *Microthyriella rubi* [apparently the ascigerous stage of *Leptothyrium pomi*: *R.A.M.*, xii, p. 788; xvi, p. 278], has been collected in the perfect form in Indiana on sugar maple (*Acer saccharum*), white oak (*Quercus alba*), *Rubus allegheniensis*, *Sassafras variifolium*, willow (*Salix nigra*), *Smilax hispida*, *Staphylea trifolia*, *Gledits[ch]ia triacanthos*, *Rhus glabra*, and *Xanthoxylum americanum*, the mature ascocarps, asci, and ascospores from each host being morphologically similar. At Lafayette the ascospores reached maturity during the first half of June. Monospore cultures on potato dextrose, oatmeal, and other agar media were secured from the first seven of the plants listed above and gave rise to slowly-growing, grey, compact colonies at temperatures from 5° to 27° C., with an optimum at 15° to 24°, the P_H range on oatmeal agar extending from 1·8 to 8·2. Attempts to induce sporulation in culture were unsuccessful, but the inoculation of immature apple fruits with mycelium from the first five of the above-mentioned hosts resulted in the production of typical fructifications, accompanied by the usual symptoms of fly-speck.

Dey (P. K.) & Singh (U. B.). **The stem-black disease of Apple in Kumaun.**—*Indian J. agric. Sci.*, ix, 5, pp. 703–710, 2 pl., 1939.

The stem-black disease of apples caused by *Coniothecium chomatosporum* [*R.A.M.*, xv, p. 586] is stated to be present in every orchard in Kumaun [United Provinces]. A survey of the Government orchards at Chaubattia in 1936 showed that 60 per cent. of the apple trees were diseased but other fruit trees were not attacked. The fungus usually infects thick branches, entering through pruned surfaces and travelling downwards, forming a jet-black streak, which slowly surrounds the whole branch; in advanced stages cankers are formed and ultimately the branches are killed. The fungus has very short hyphae, dark brown conidiophores, and irregular, circiniform, muticate, non-catenulate, often coalescent and very variable conidia, 8·4 to 36·4 by 5·6 to 30·8 μ, or on the average 16·3 by 11·4 μ. Chlamydospores were formed in nature and both these and the conidia germinated readily in tap water within 24 hours, only about 5 per cent. of them growing directly into germ-tubes, while the rest released a large number of minute, hyaline secondary spores, measuring 2·8 to 7 by 2·8 to 6·3 μ. These in turn either formed germ-tubes or produced buds which germinated.

Artificial inoculations with single-spore isolations of the fungus were successful when drops of the spore suspension were placed on injured surfaces of the stem, but in no case did infection take place on uninjured surfaces. Inoculations of pruned surfaces with pure cultures of the fungus resulted in infection in seven to ten days, the organism being reisolated in every case. In culture the fungus grew on oatmeal, Brown's starch-synthetic, and Czapek's agars, but formed chlamydospores only. Growth was generally very slow; it was inhibited by a temperature of 86° F., but was resumed after the temperature was lowered. In Kumaun the pycnidial stage was not encountered and the fungus was observed to overwinter in the mycelial form. The primary conidia and possibly

the minute spores produced by budding from the secondary spores are believed to be the sources of infection, which usually appears in July and is at its height by the middle of August. Great numbers of both types of spores were caught in spore traps and found in rain drops, indicating that the infection is carried by wind and rain water.

In areas where the disease is established, careful pruning of the affected parts is recommended, while to prevent new infection the use of a dressing on cut surfaces is advised. Of a number of pastes tested, one consisting of 2 oz. red lead, 2 oz. copper carbonate, and 100 c.c. raw linseed oil proved most effective.

Walkley (A.) & Kemp (H. K.). **The occurrence of boron and manganese deficiencies in a sandy soil.**—*J. Aust. Inst. agric. Sci.*, v. 4, pp. 229–230, 1 fig., 1939.

During the past few years, plum trees growing at McLaren Flat, South Australia, in a sandy soil experimentally shown to produce symptoms of boron deficiency in various plants grown in pot cultures, have been affected by a condition resembling little leaf or rosette [*R.A.M.*, xviii, p. 261]. The growth at the tips of the main branches becomes chlorotic, and the leaves are dwarfed and misshapen: eventually, such growth becomes arrested, and in the following season severe die-back sets in, and continues to progress annually. Growth round the base of the tree becomes abnormally vigorous. Strong, apparently healthy, lateral growths develop, from which the main branches may be re-established in two or three seasons, but these branches in turn become affected. Manurial trials with various minor elements are in progress.

Dunegan (J. C.). **Unusual bacterial spot symptoms on Peach leaves.**—*Phytopathology*, xxx, 1, pp. 88–89, 1 fig., 1940.

A virulent outbreak of bacterial spot of peach (*Bacterium pruni*) in an 18-month-old Elberta orchard in Arkansas in June, 1939, was characterized by anomalous foliar symptoms consisting in the complete infiltration of large areas with the bacteria, imparting a greenish-yellow, translucent aspect under transmitted light and entailing the total disorganization of the cellular structure. The ground beneath the trees was strewn with leaves showing these atypical features, while others, detached from the twigs, adhered to the adjacent foliage by the mixture of gum and bacteria exuding from the diseased areas. Pure cultures of the pathogen were secured from the infiltrated tissues.

Hildebrand (E. M.) & Palmiter (D. H.). **Yellow-red or 'X' disease: a new threat to Peach industry.**—Abs. in *Phytopathology*, xxx, 1, p. 10, 1940.

Since its first detection in Connecticut in 1933, the yellow-red or 'X' disease of peaches [*R.A.M.*, xix, p. 228] has spread nearly across the United States, affecting all cultivated varieties but only the choke-cherry (*Prunus virginiana*) among wild plants. From mid-June until the autumn the characteristic foliar symptoms of yellowing, irregular red spots, shot hole, and shedding are continuously present but seldom cause death in orchard trees, though those in the greenhouse succumb

after complete defoliation. Leaf fall is accompanied by fruit drop, but small mummies often remain attached. The sequence of symptoms in *P. virginiana*, namely, striking red and yellow foliage, succeeded by rosetting and ultimate death, is usually repeated year by year, though with considerable overlapping. During the first and second seasons from the inception of the disease the maximum counts of infection made in peach orchards were 62 and 96 per cent., respectively, the extent of involvement ranging from single shoots to entire trees. The symptoms may not appear for a year or more after inoculation by budding. The soundest control measure consists in the eradication of *P. virginiana*, on which the spread of infection is very rapid, from the vicinity of peach orchards.

HARRIS (R. V.). **Mosaic disease of the Raspberry in Great Britain. II. Experiments in transmission and symptom analysis.**—*J. Pomol.*, xvii, 4, pp. 318–343, 4 pl., 1 fig., 1940.

In continued studies on raspberry mosaic [*R.A.M.*, xiii, p. 248; cf. ibid., xix, p. 31], the author found that all attempts to transmit the disease by mechanical means gave negative results. Preliminary experiments carried out in 1926–7 showed that the disease can be transmitted to healthy plants of Baumforth's Seedling B by cleft grafting and during 1928–37 transmission was successfully achieved from ten varieties to healthy Baumforth's B and Lloyd George plants by this method and also by three variants of patch grafting, viz., the ring, the panel, and the inarching methods [which are described in detail]. An analysis of leaf symptoms in three raspberry varieties showed that they can be referred to two etiologically distinct groups, mosaic 1 and 2, the first typified by *b* symptoms [ibid., xiii, p. 248], on the indicator variety Baumforth's B; and the second by *c* symptoms on the same variety, *a* and *?c* on Mitchell's Seedling, and by indeterminate symptoms on Norwich Market. Mosaic 1 behaves as a single disease, probably of single virus origin, uniformly mild in character and of comparatively restricted varietal distribution. Mosaic 2 includes two or more diseases differing in intensity from mild mosaic, with slight and evanescent type *c* symptoms and undetectable or very slow decline of the plant, to severe mosaic with intense and concentrated type *c* leaf symptoms and rapid decline and death of the plant. The possible relationship of mild and severe symptoms of mosaic 2 is discussed, but further data are necessary to draw final conclusions. Mosaic 2 was transmitted from ten varieties, which varied greatly in their susceptibility to this form of disease. Thus, Baumforth's B and Mitchell's Seedling are very susceptible and their stools are rapidly rendered unproductive and die, while Red Cross is totally infected but highly resistant, and on Lloyd George and some other varieties both mild and severe types of mosaic 2 may be masked or the symptoms very irregularly expressed. Combined infection with mosaics 1 and 2 was observed in the field and the severe mosaic on Lloyd George consists of such infection.

TIMS (E. C.). **Control of leaf blights of Fig.**– Abs. in *Phytopathology*, xxx, 1, p. 25, 1940.

In 1937 and 1938 practically complete control of the fig thread blight

caused by *Corticium stevensii* [*R.A.M.*, xiv, p. 795] was obtained with some copper sulphate-lime-arsenite eradicant sprays in Louisiana, where Bordeaux mixture has proved ineffectual for the purpose. For instance, several trees treated with a mixture containing copper sulphate, lime, zinc arsenite, monocalcium arsenite, and fish oil in 1938 remained healthy in 1939, denoting the extermination of the sclerotia of the parasite. In 1939 the trials were complicated by the development of another leaf-blighting fungus, *C. microsclerotia*, which caused widespread and severe premature defoliation and recurred to some extent following the harvest in July, though apparently amenable in the early stages to control by the above-mentioned mixture.

Wallace (G. B.). **Cercospora leaf-spot of Banana (C. musae).**—*Mycol. Circ.* [*Tanganyika*] 5, 3 pp., 1939. [Mimeographed.]

Banana leaf spot (*Cercospora musae*), first recorded in East Africa by Hansford in Uganda in 1938, was found by H. P. Smart in June, 1939, on the Tanganyika coast between Dar-es-Salaam and Lindi, and in August near Pugu, on the Central Railway, the author also observing the disease in the latter month near Korogwe, Tanganyika Territory, at an elevation of nearly 1,000 ft.

Wardlaw (C. W.), Baker (R. E. D.), & Crowdy (S. H.). **Latent infections in tropical fruits.**—*Trop. Agriculture, Trin.*, xvi, 12, pp. 275–276, 1939.

Much of the subject-matter of this paper has already been noticed from another source [*R.A.M.*, xviii, p. 193]. When a spore suspension of *Colletotrichum gloeosporioides* in water was applied to the surface of papaw fruits of any age at temperatures of 80° to 90° F. in a saturated or nearly saturated atmosphere the spores germinated rapidly and formed appressoria in about nine hours. Subsequent development did not appear to require such moist conditions, and penetration of the epidermis or sometimes entry through a stoma occurred after about 24 hours. The later behaviour of such infections was closely comparable with normal latent infections. The information gained from the study of latent infections has found practical application in the control of mango anthracnose (*C. gloeosporioides*) [ibid., xvii, p. 403] in Trinidad where it has been shown that in certain seasons five sprayings may definitely reduce the intensity of the disease developing in storage from latent infections.

Smith (W. P. C.). **Brown spot, a serious disease of the Passion Vine.**—*J. Dep. Agric. W. Aust.*, xvi, 4, pp. 445–450, 4 figs., 1939.

During an inspection tour of some of the major areas of passion vine (*Passiflora edulis*) cultivation in Western Australia, the author observed a serious attack of brown spot disease of this crop, caused by *Alternaria passiflorae* [*R.A.M.*, xvii, p. 695]. A characteristic symptom of the disease was the development of dark brown lesions on the branches, which become girdled, resulting eventually in the death of all distal parts, the leaves usually remaining fresh and green much longer than the fruit, which may suddenly wilt. Brown spot is favoured by warm, moist weather and in normal seasons is most serious in the spring and

early summer. The following are the chief recommendations for control: training of vines on trellis wires; systematic pruning at least once a year, taking care to cut out all diseased lesions and to burn all prunings; spraying the vines after pruning with 4–4–40 Bordeaux mixture plus a spreader at monthly intervals during spring and early summer, and thereafter at intervals of two months if required by the season (ammoniacal copper carbonate may be substituted for the Bordeaux mixture in order to avoid discoloration of mature fruit); periodical examination of all vines and destruction of all new lesions found; and reduction to a minimum of all artificial watering, overhead watering being discouraged in home gardens.

Stationary spray plants. Success in Victoria.—*Fruit World, Melbourne,* xli, 1, p. 6, 1940.

Reports from fruit growers in Victoria state that the central stationary spray plants [*R.A.M.*, xv, p. 379; xvi, p. 547] installed continue to give satisfaction, the spraying costs being reduced by as much as half and applications being possible on land unfit to carry the ordinary outfit.

Müller (H.). **Prüfungsbericht über die Regelvorrichtung für das selbsttätige Zuteilen von Beizpulver beim Röberschen Trockenbeizer (Bauart Dr. Stümpfig) der Firma Gebr. Röber GmbH, Wutha i. Th.** [Report of tests on the regulating device for the automatic distribution of the disinfectant dust in the Röber dusting appliance (Dr. Stümpfig's construction) of the firm of Röber Bros. Ltd., Wutha (Thuringia).]—*Masch. u. Geräteprüf. Reichsnährst.* (Suppl. to *Tech. in d. Landw.*), v, 1, pp. 5–6, 1 fig., 1940.

In collaboration with S. Reeh, A. Winkelmann, and K. Ebertz, the writer tested a device for the automatic regulation of distribution of the dust in the 'Saatfreund' seed-grain dusting apparatus, for use with the Petkus steel type 30 installation, and found it satisfactory for the purpose in view.

Brown (C. C.). **Contribution toward a host index to plant diseases in Oklahoma.**—*Circ. Okla. agric. Exp. Sta.* 33, 73 pp., 1939. [Mimeographed. Abs. in *Exp. Sta. Rec.*, lxxxii, 2, p. 200, 1940.]

This preliminary annotated check list, alphabetically arranged by the Latin names of the 284 cultivated and wild hosts, of 819 plant diseases in Oklahoma due to bacteria, fungi, phanerogams, viruses, and environmental conditions, is intended to serve as a framework for the further study of the occurrence, distribution, and importance of such disorders in the State.

Behr (L.). **Künstliche Immunisierung der Pflanzen.** [The artificial immunization of plants.]—*Umschau,* xliii, 48, pp. 1039–1040, 1939.

This is a concise critical survey, illustrated by concrete examples, of the present status of knowledge concerning the artificial immunization of plants against fungal and bacterial diseases.

Hoffman (C.), Schweitzer (T. R.), & Dalby (G.). **Fungistatic properties of the fatty acids and possible biochemical significance.**—*Food Res.*, iv, 6, pp. 539–545, 6 graphs, 1939.

At the Ward Baking Company, New York, the fungistatic properties of the normal saturated fatty acids containing 1 to 14 carbon atoms were studied over a hydrogen-ion range from P_H 2 to 8, and many of them were found to be remarkably effective in the inhibition of growth of some common moulds, such as *Aspergillus niger*, *A. glaucus*, *Rhizopus nigricans*, and *Penicillium frequentans* isolated from spoiled food products and cultured on raisins moistened with nutrient agar. Generally speaking, the branched chain acids were found to be more toxic to the fungi than the corresponding straight ones, the most powerful at a neutral reaction being those containing 8 to 12 carbon atoms. At P_H 2 and 3 formic acid was more active than acetic in the suppression of the moulds, whereas above 3 the latter was slightly stronger. Beta-iodopropionic acid probably exerts both a fungicidal and a fungistatic action, proprionic acid being mainly fungistatic.

Pfankuch (E.). **Trübungsmessungen an Virusproteinen bei verschiedenen Aciditäten.** [Turbidity determinations on virus proteins at various acidities.]—*Biochem. Z.*, ciii, 5–6, pp. 342–348, 1 graph. 1940.

In further studies on plant virus proteins the writer determined the turbidity relations of the tobacco mosaic, tomato aucuba mosaic, and potato-X viruses [*R.A.M.*, xix, p. 48] over a wide range of hydrogen-ion concentrations (P_H 2 to 9). As in previous experiments, the curves of the tobacco and tomato aucuba mosaics were in substantial agreement, proceeding at an even rate from the alkaline side to P_H 4, at which point they rose sharply to reach a turbidity maximum at about 3·3, whereas the behaviour of potato virus X was again quite anomalous and no well-defined climax was attained. The specific viscosity of the tobacco mosaic virus showed a peak (223 gm. protein per c.c.) at P_H 4·24, with a secondary maximum on the acid side (3·03) of the isoelectric point. The minimum viscosity (50·2 gm. protein per c.c.) coincided with the maximum turbidity at the isoelectric point in consequence of maximal lateral aggregation of particles.

Herbert (D.). **Plant viruses in Queensland I.**—*Pap. Dep. Biol. Univ. Qd*, i, 11, 4 pp., 1 pl., 1939.

In addition to curly top of the well-known weed *Galinsoga parviflora* attributed to a virus designated *Galinsoga* virus 1, two other viruses are recorded from Queensland, viz., lily mosaic (*Cucumis* virus 1) [*R.A.M.*, xix, p. 132], which developed in the autumn of 1939 in cucumbers and tomatoes in the north of the State, and *Dahlia* mosaic [cf. ibid., xvii, p. 443].

Tomato spotted wilt is prevalent on a wide range of hosts and during 1939 was responsible for heavy losses among Iceland poppies [*Papaver nudicaule*: ibid., xvii, p. 730].

How (J. E.). **The mycorrhizal relations of Larch. I. A study of Boletus elegans Schum. in pure culture.**—*Ann. Bot., Lond.*, N.S., iv, 13, pp. 135–150, 1 fig., 8 graphs, 1940.

The present cultural study of *Boletus elegans* [*R.A.M.*, xviii, p. 542] was undertaken in order to discover if possible the cause of the specialized relation of this fungus to larch. An examination of the mycelium showed it to be morphologically very similar to that of other species of *Boletus*. Growth in pure culture was found to be affected adversely by concentrations of the nutrient solution greater than about 0·2 M. The fungus utilized sugars, starch, and pectin, but not cellulose or lignin and as a source of nitrogen preferred inorganic ammonium salts, though it was capable of using nitrate, asparagin, peptone, and gelatine. The maximum range of hydrogen-ion concentration for growth on media containing glucose, salts, and inorganic nitrogen compounds was P_H 3·0 to 3·2 and 6·4. These results reveal no clue to the relationship of the fungus to the host and it is concluded that a pure culture study, while an essential preliminary, is not likely to lead to a solution of the problem of the behaviour of a soil fungus such as *B. elegans*; further studies should be directed to the fungus in relation to other members of the soil flora and the host plant.

Childs (J. F. L.). **Diurnal cycle of spore maturation in certain powdery mildews.**—*Phytopathology*, xxx, 1, pp. 65–73, 1 fig., 2 graphs, 1940.

A tabulated account is given of the writer's studies at the University of California on the cycle of morphological development of the conidiophores of *Erysiphe cichoracearum* from sunflower, cucumber, and *Aster* sp., *Podosphaera leucotricha* from apple, *Sphaerotheca pannosa* from rose, *E. polygoni* from bean (*Phaseolus vulgaris*), and *Oidium euonymi-japonici* from *Euonymus japonicus* [*R.A.M.*, xviii, p. 465], freshly infected leaves being collected at two-hourly intervals over 24-hour periods at Berkeley in July 1937 and June to July 1938.

The conidiophores examined exhibited the two types of conidial production differentiated by Blumer [ibid., xiii, p. 127], viz., the non-chain-forming, represented by *E. polygoni* and *O. euonymi-japonici*, and those forming chains of two to eight or more conidia, characteristic of the other mildews under observation. The diurnal cycle of conidiophore development in the two members of the former group was found to be similar to that reported by Yarwood for *E. polygoni* on clover [ibid., xv, p. 659], the period of conidial abstriction occurring between 10 a.m. and 2 p.m. in both instances. In the mildews of the chain-forming group the process of development is more complex, abstriction of the conidia taking place during the period from between 6 and 8 a.m. to between 2 and 4 p.m. and the formation of the succeeding crop from between 2 and 4 p.m. to between 6 and 8 a.m. in all cases. In *E. cichoracearum* from sunflower the peak of conidial abstriction was reached between 8 a.m. and 2 p.m., as shown by the periodical catching of dislodged spores for several days. The results of these spore maturation and liberation counts were in substantial agreement with those obtained by microscopic examination.

Stained conidiophores of the sunflower powdery mildew were shown

by microscopic inspection to contain two nuclei either in the basal cell or in that immediately above it, probably indicating that both cells are capable of functioning generatively.

PRYOR (D. E.), WALKER (J. C.), & STAHLMANN (M. A.). **Toxicity of allyl isothiocyanate vapor to certain fungi.**—*Amer. J. Bot.*, xxvii, 1, pp. 30–38, 3 figs., 1940.

The toxicity of different concentrations of allyl isothiocyanate (mustard oil) vapour to spores and mycelium of *Colletotrichum circinans*, *Gibberella saubinetii*, *Aspergillus alliaceus*, and *A. niger* [cf. *R.A.M.*, xvii, p. 196] was tested by the method described in a previous paper [ibid., xviii, p. 753]. By partial pressure experiments it was found that the toxicity of the vapour in equilibrium with an aqueous solution depended on both the concentration and the amount of oil present in the solution. At high concentrations of vapour fungal growth in a closed system was inhibited provided sufficient oil was potentially available in the solution to maintain the inhibitory concentration of vapour; at lower concentrations growth was not inhibited even when the amount of potentially available oil in the solution was many times (three in the case of *G. saubinetii*) the quantity which would be inhibitory at a slightly higher concentration. These results are held to indicate that allyl isothiocyanate, unlike certain metallic ions, cannot act in a cumulative manner. The amount of oil needed to inhibit enlargement of colonies varied little for cultures 0 or 24 hours old, but it was higher when older thalli were used. In the series with 72-hour-old cultures *C. circinans* and *A. alliaceus* rapidly grew more resistant, while *G. saubinetii* and *A. niger* became only slightly more tolerant to the oil over the same period. Spores exhibited greater variability in tolerance to the oil than mycelium of any age tested. The amount of oil necessary to prevent the appearance of colonies from spores of *C. circinans* and *G. saubinetii* was less than the amount which stopped colony enlargement; with *A. alliaceus* the amount varied with the age of mycelium at the time of exposure; and with *A. niger* about the same or slightly more oil was required to prevent the appearance of the colony than to stop mycelial growth over the period tested. Colonies of *C. circinans* and *G. saubinetii* were generally killed at the point where growth ceased, while those of *A. alliaceus* and *A. niger* were merely inhibited and two to four times the inhibitory amount was required to kill them. The smaller the spore load the smaller was the amount of toxic material required to prevent germination.

LUCAS (HILDE). **Weitere Untersuchungen über den Wuchsstoffhaushalt abbaukranker Kartoffeln.** [Further studies on the auxin economy of 'degenerate' potatoes.]—*Phytopath. Z.*, xii, 4, pp. 334–350, 1 fig., 1 diag., 2 graphs, 1939.

In continuation of Jahnel's studies on the relation of auxins to health and 'degeneracy' in potatoes [*R.A.M.*, xviii, p. 758], the writer investigated by the diffusion method at the Dresden Technical College the comparative values in this respect of sound and diseased material of the Parnassia, Odenwälder Blaue, Industrie, and Direktor Johanssen varieties.

In the early stages of growth there was little difference in auxin distribution between healthy and diseased plants, but in the course of development the latter were found to show a marked decline in auxin content, especially in the stem tips and leaves approaching maturity. For instance, the stem tips of 'degenerate' plants of the four varieties (in the order given above), contained 84, 76, 93, and 79 per cent. less than healthy ones, the corresponding values for the maturing foliage being 58, 47, 36, and 56 per cent., respectively. The young daughter tubers, too, only begin to show an auxin deficiency (23, 8, 13, and 44 per cent., respectively) in the later stages of development. Using methods based on the Went pea test (Jost, *Z. Bot.*, xxxiii, p. 193, 1938; Thimann and Schneider, *Amer. J. Bot.*, xxv, p. 627, 1938), the writer found that the petioles of diseased plants respond less actively than those of healthy ones to dilute concentrations of heteroauxin.

Wenzl (H.). **Zur Frage nach dem Wesen der Braunmarkigkeit (Hohlherzigkeit) der Kartoffelknollen.** [A contribution to the question of the nature of medullary browning (hollow heart) of Potato tubers.] — *Phytopath. Z.*, xii, 4, pp. 351–359, 1939.

Evidence is summarized from the writer's observations and experiments in Austria, supported by a perusal of the relevant literature, to refute the hypotheses of Cristinzio [*R.A.M.*, xiii, p. 722] and Gigante [ibid., xv, p. 458] as to the virus origin of potato hollow heart [ibid., xviii, p. 134]. The principal arguments against the virus and in favour of the physiological theory of the etiology of the disease are as follows. Its transmissibility has not been proved. The aerial portions of the plants show no symptoms. There is no decline in yield. The incidence of the disorder is strictly proportionate to the size of the tubers, and the occurrence of the disease is markedly dependent on environmental factors tending to induce either the formation of large tubers or secondary expansion after the cessation of normal growth. Diseased tubers yield exclusively sound progeny under local conditions unfavourable to hollow heart, while even in sites particularly conducive to the trouble a portion of the crop is sound.

Bonde (R.). **Bacterial wilt and soft rot of the Potato in Maine.**—*Bull. Me agric. Exp. Sta.* 396, pp. 675–694, 4 figs., 1939.

Some of the information given in this bulletin on bacterial wilt and soft rot of potatoes (*Phytomonas sepedonica*) [*Bacterium sepedonicum*: *R.A.M.*, xviii, p. 201; xix, p. 235] has already been noticed from another source [ibid., xviii, p. 613], but the following items may be noted. In 1937 and 1938 the disease caused losses in Maine estimated at $32,000 and nearly $80,000, respectively. As a rule, the foliage symptoms do not become evident until late in the growing season. The first symptom in the field is a slight wilting of the leaves and stalks. The affected leaves are mottled, chlorotic, and sometimes pale green, develop marginal necrosis, and gradually die. In some cases the plants are killed. The underground parts of the small stalks of diseased plants sometimes develop longitudinal cracks but the vascular bundles of wilted plants remain normal in colour. Tubers may appear to be

unaffected, or may show symptoms ranging in severity up to complete disintegration [ibid., xvi, p. 628].

Pethybridge (G. H.). **The Potato blight yesterday and to-day.**—*Polytech. Rep.* (*R. Cornwall Polytech. Soc.*), ix, 3, pp. 48–61, 1940.

In this interesting historical survey of the spread of potato blight (*Phytophthora infestans*) during the early forties of the last century mention is made of a paper, hitherto overlooked, by D. F. Tyerman published in the *Fourteenth Ann. Rep. R. Cornwall Polytech. Soc.*, pp. 9–14, 7 figs., 1846, in which the cause of potato blight was correctly ascribed to a parasitic mould or fungus, though this was not named. The progress made by plant pathologists in the hundred years since the probable record of the disease in St. Helena in 1840 is discussed and the main results are given on the cause and nature of it, factors influencing its development, and means of control.

Gretschushnikoff (A. I.). **Role of peroxidase in immunity against Phytophthora infestans de Bary.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxv, 8, pp. 683–687, 1939.

In further studies on the nature of potato resistance to *Phytophthora infestans* [*R.A.M.*, xviii, p. 271] the following figures were obtained for the activity of peroxidase in potato leaves (expressed as c.c. of n/10 potassium permanganate solution per gm. of fresh leaves): Early Rose (a very susceptible variety) 14·6, *Solanum rybinii* (susceptible) 13·7, Wohltmann (moderately susceptible) 19·0, and No. 8670 (resistant) 21·2. In a second experiment the peroxidase activity (expressed in arbitrary benzidine units per gm. of fresh leaves) was 70·21 in Early Rose, 93·83 in the susceptible Smyslovsky, and 112·81 in No. 8670. The peroxidase activity in the tubers (expressed by the benzidine method) was 2·79 in Early Rose, 3·01 in Wohltmann, and 3·54 in No. 8670. It was thus shown that peroxidase activity in both the leaves and tubers of resistant varieties was higher than in those of lesser resistance and it is concluded that the peroxidase fulfils a protective function against infection by *P. infestans*.

At a soil humidity of 80 per cent. the peroxidase activity (estimated by the benzidine method) was 189·43 for Wohltmann and 137·53 for No. 8670, as compared with 278·89 and 233·49, respectively, at a soil humidity of 20 per cent.; in tubers of the same varieties the corresponding figures were 2·54 and 2·05, and 2·63 and 2·59, respectively. It appears thus that high soil humidity is correlated with low peroxidase activity in both leaves and tubers, although in the latter the peroxidase activity is always much reduced and the dependence on soil humidity is less marked. These results are held to indicate that excessive humidity is conducive to greater danger of infection by *P. infestans*, because it not only favours the development of the fungus but also decreases the resistance of the host plant.

The activity of peroxidase was also found to decrease with shorter day lengths: in leaves of the varieties Early Rose, Wohltmann, and No. 8670 from plants grown at a curtailed day length (eight hours) the decrease in peroxidase activity was 8·1, 48·1, and 35·6 per cent., respectively.

The resistant No. 8670 was found to have both the highest peroxidase and cystoamylase values, while the susceptible Epicure had the lowest, varieties of intermediate reaction having values between these extremes; these results indicate that there is a correlation between the peroxidase and cystoamylase activities. It is suggested that the cystoamylase and peroxidase indices (when determined on comparable material) can be safely used as a basis for the assessment of the resistance of a potato plant to *P. infestans*.

Chiappelli (R.). **Lo sclerozio del Riso.** [The Rice *Sclerotium*.]—*Risicolt.*, xxix, 11, pp. 319–321, 8 figs., 1939.

A popular note is given on the disease of rice caused in Italy by *Sclerotium* [*oryzae*: *Leptosphaeria salvinii*: *R.A.M.*, xvi, p. 405; xvii, p. 128], which in 1939 attacked the Maratelli and Vialone varieties in addition to the normally susceptible Sesia. The substitution of the semi-resistant Chinese Original or American 1600 for the susceptible varieties is indicated in cases of persistent infection.

Reyes (G. M.). **Rice diseases and methods of control.**—*Philipp. J. Agric.*, x, 4, pp. 419–436, 15 pl., 1 map, 1 diag., 1939.

In this illustrated survey of rice diseases in the Philippines [*R.A.M.*, vi, p. 371] the following diseases are discussed: *Sclerotium rolfsii* [ibid., xiv, p. 315], *Helminthosporium oryzae*, *Piricularia oryzae*, *Leptosphaeria salvinii* [ibid., xvi, p. 660], *S. sphaeroides* [*Rhizoctonia microsclerotia*: ibid., xv, p. 313], *R. solani*, *Tilletia horrida* [ibid., xv, p. 80], straight-head, various physiological diseases, and the minor diseases *Ustilaginoidea virens*, *Entyloma oryzae*, and *Cercospora oryzae* [ibid., xiv, p. 331; xv, p. 255]. 'Palay lalake' is a comparatively new disease of increasing economic importance. It generally appears about a month after transplanting and is easily recognized in the field by the narrow, light-green leaves and the lanky growth of the affected plants. The pinkish-white mycelium of a species of *Fusarium* [cf. ibid., xiv, p. 120; xv, p. 80] may be seen in the advanced stages of the disease growing on the stem above the water surface, especially around the nodes. The diseased plants should be rogued out as soon as noticed and buried, the stubble burnt, and the diseased field ploughed after harvest. Care should be taken not to spread the disease by mechanical means and seed rice should be taken from disease-free fields. The varieties Macan Bino, Apostol, Macan Biñan, and Guinangang strain 1 proved in some degree resistant to the disease.

Ryker (T. C.). **Physiological specialization in Cercospora oryzae.**—Abs. in *Phytopathology*, xxx, 1, p. 21, 1940.

Leaf spot (*Cercospora oryzae*) is stated to be the most serious disease of Blue Rose rice, the variety normally covering about 75 per cent. of the Louisiana acreage [*R.A.M.*, xvii, p. 201]. From some sound plants collected in a heavily infected field in 1936, a selection, 2854–3, was obtained combining resistance to the pathogen with entire conformity to the Blue Rose type. In artificial inoculation experiments in 1939, however, the new line was completely susceptible, suggesting the existence of more than one physiologic race of *C. oryzae*. To test this hypothesis, 20 cultures of the fungus were used in inoculations on Blue

Rose, Fortuna, 2854–3, and Caloro, with the result that at least three groups were distinguished, namely, (1) Blue Rose susceptible and the other three varieties resistant; (2) 2854–3 susceptible, Blue Rose moderately so, Caloro and Fortuna resistant; and (3) Blue Rose and Caloro susceptible, 2854–3 and Fortuna resistant. Field observations point to the occurrence of yet other races. Some varieties, however, appear to be uniformly resistant to all strains of the parasite.

Ghatak (P. N.) & Roy (T. C.). **Studies in the soil fungi of the Paddy-fields of Bengal. I. Fungi of an unmanured Paddy-field of the Chinsurah Agricultural Farm.**—*J. Indian bot. Soc.*, xviii, 3, pp. 113–127, 16 figs., 1939.

From soil samples from an unmanured rice field on the Chinsurah Agricultural Farm, near Calcutta, the writer isolated on Czapek's medium 23 fungi including, in addition to several Phycomycetes and species of *Aspergillus* and *Penicillium*, *Fusarium dimerum*, *F. orthoceras*, *F. oxysporum*, and *F. solani*.

Weigert (J.) & Fürst (F.). **Die Wirkung von Spurenelementen in den Randgebieten südbayerischer Moore.** [The influence of trace elements on the outskirts of the south Bavarian marshes.]—*Prakt. Bl. Pflanzenb.*, xvii, pp. 117–140, 1939. [Abs. in *Ber. wiss. Biol.*, lii, 11–12, p. 699, 1940.]

Of recent years many economic crops on the outskirts of the south Bavarian marshes, especially oats, barley, summer wheat, maize, hemp, potatoes, and beets, have been suffering from abnormalities of growth entailing substantial losses and in some cases complete failure. The principal disease is grey speck [*R.A.M.*, xix, p. 6], beets being also affected by heart and dry rot. Exhaustive field and pot fertilizer experiments showed the troubles to be due to manganese and boron shortage and controllable by the application of these elements (as manganese sulphate and boron superphosphate) to the soil, the former at the rate of about 50 kg. per hect. and the latter at discretion.

Hoerner (G. R.). **The relation of the climatology of Western Oregon to the incidence and control of downy mildew of Hops.**—*Plant Dis. Reptr*, xxiii, 22, pp. 361–366, 4 graphs, 1 map, 1939. [Mimeographed.]

Hop downy mildew (*Pseudoperonospora humuli*) was first recorded in Oregon in 1930, and has since been reported from every hop-growing county in the western part of the State. While it is true that comparatively low temperatures and high relative humidity favour infection, it must be remembered in attempting to estimate resistance that highly variable local conditions may obtain. Individual plants which had appeared to be highly resistant to natural infection for several years in one breeding garden proved to be very susceptible under epidemic conditions. Spread occurs in the direction of the prevailing winds. Experimental evidence failed to demonstrate that the mycelium is systemic in perennial portions of infected plants. Infections occurring early in the season and resulting in the formation of spiked shoots from apparently healthy crowns have been attributed to oospores that have

overwintered in infected hop residue in the soil. Control measures have therefore been directed to the suppression of early infection by disinfection of the soil round the crowns [*R.A.M.*, xix. p. 166] and protection of the growing plants with a fungicide, but their rapid growth makes it virtually impossible to maintain uniform and complete coverage. A careful study of the climatological data for western Oregon during the past ten years indicated that the monthly mean temperature was not particularly unfavourable to the fungus throughout this period, whereas the monthly mean rainfall was much more variable and more closely correlated with infection. The variations in rainfall were too great to afford any basis for an accurately timed spraying programme. Local growers should apply the main part of their treatments before 1st July; if infection can be minimized until then, the risk of serious loss later should be greatly reduced.

Illitchevsky (S.). Фітопатологічні збори в УРСР. [Phytopathological collections in the Ukrainian S.S.R.]—*ex* Symposium dedicated to the memory of A. V. Fomin, Acad. Mem., Kieff, Ukr. S.S.R. Acad. of Sci. Press, pp. 149–157, 1938. [Received February, 1940. English summary.]

This is a list of 137 parasitic fungi, chiefly Uredinales, collected by the author since 1923 in the Ukrainian S.S.R. Mosaic mottling of lilac [*R.A.M.*, xiv. pp. 462, 494], characterized by wilted and dried leaves, is recorded as prevalent in two localities in 1932 and 1933, respectively.

Wang (Y. C.) & Martens (P.). **Sur l'origine de la dicaryophase chez quelques Urédinées.** [On the origin of the dicaryophase in some Uredineae.]—*Trav. biol. Inst. J. B. Carnoy, Louvain,* 33, pp. 215–245, 81 figs., 1939.

This is an exhaustive account of the writers' studies on the origin of the binucleate phase in the rusts *Puccinia caricis* on *Urtica dioica*, *P. coronata* [*R.A.M.*, xii, p. 164] on *Rhamnus frangula*, *P. poarum* on *Tussilago farfara*, *Uromyces poae* on *Ranunculus ficaria*, and *P. malvacearum* [ibid., xii, p. 782] on *Malva rotundifolia*. A number of observations were made pointing to the intervention of pycnospores in the initiation of dicaryopsis, e.g., pycnospores apparently in process of germination or conjugation on the leaf surface, a pycnospore affixed to a paraphysis or a pycnophore, and paraphyses with supernumerary nuclei. On the other hand, in the foliar tissues, among the pycnidia, young aecidia, and the bulk of the uninucleate cells occur frequent binucleate cells, cells with conjugate mitoses, occasionally binucleate cells delimited by typical clamp-connexions ['anses d'anastomose'], and binucleate cells with one nucleus in course of division. As regards the aecidia, the initiation of the first dicaryon at the expense of a lateral fusion between two fertile cells (Christman's 'two-legged cells': *Bot. Gaz.*, xxxix, pp. 267–275, 1905) was in no case observed, and in fact this mode of origin is contra-indicated by some aspects of the present investigations. In *P. caricis* the binucleate cell at the base of one or more chains of aecidiospores receives its two nuclei from a regularly plurinucleate cell underlying the fertile cells. Hyphae presenting an

appearance of 'receptivity' were detected only in the single species (*P. malvacearum*) destitute of pycnidia.

Brown (A. M.). **The sexual behaviour of several plant rusts.**—*Canad. J. Res.*, Sect. C., xviii, 1, pp. 18–25, 3 pl., 1940.

In greenhouse experiments in Ottawa, the following three rusts proved to be heterothallic: *Uromyces trifolii hybridi*, *Phragmidium speciosum*, and *U. fabae*. All produced well-developed pycnidia and *U. fabae* occasionally omitted the aecidial stage or produced uredosori and aecidia in association. On the other hand, *Puccinia coronata elaeagni* [*R.A.M.*, xii, p. 362], *P. grindeliae*, and *P. xanthii*, are homothallic, single sporidia of these species giving rise spontaneously to binucleate infections. Ashworth's conclusion [*Trans. Brit. mycol. Soc.*, xvi, pp. 177–202, 1931] that *P. malvacearum* is homothallic was also confirmed.

Since all the rusts so far known to be heterothallic possess well-developed pycnidia, while in the four homothallic species pycnidia are either absent or under-developed, it would appear that the presence of pycnidia may be taken as an indication of heterothallism and their absence or under-development of homothallism.

Fisher (Eileen E.). **Notes on some Australian sooty moulds.**—*Ann. Bot., Lond.*, N.S., iv, 13, pp. 195–197, 1 fig., 1940.

A new combination, *Chaetothyrium citri* (Arn.) Fisher, is proposed for *Pleosphaeria citri* (syn. *Aithaloderma citri*), a fungus recorded for the first time in Australia, on *Alyxia buxifolia* and *Bursaria spinosa*. A description [with a Latin diagnosis] is also given of a new species, *Phycopsis australiensis*, found on leaves of *B. spinosa* in Victoria [cf. *R.A.M.*, xviii, p. 627].

Thom (C.) & Raper (K. B.). **The Aspergillus nidulans group.**—*Mycologia*, xxxi, 6, pp. 653–669, 6 figs., 1939.

The authors divide the *Aspergillus nidulans* group into five species based primarily on ascospore characters, viz., *A. nidulans*, *A. quadrilineatus* n.sp., *A. rugulosus* n.sp., *A. variecolor* n. comb. (syn. *Emericella variecolor* Berk & Br.), and *A. unguis* n. comb. A new variety, *A. nidulans* var. *latus*, is described, and Yuills' *A. nidulans* mut. *albus* [*J. Bot.*, Lond.; in the press] is accepted.

Wallace (J. M.). **Evidence of passive immunization of plants from curly top.**—Abs. in *Phytopathology*, xxx, 1, pp. 26–27, 1940.

Following recovery from curly top [in California], Turkish tobacco plants showed mild symptoms and did not react perceptibly to re-inoculation [*R.A.M.*, xviii, p. 823]. However, leafhopper transmission from recovered plants induced severe manifestations, denoting the unimpaired virulence of the infective principle. Graft transmission, on the other hand, resulted in mild symptoms, indicating the presence in the recovered plants of protective substances or properties transferable by grafting. The results of tests in which scions from leafhopper-inoculated plants were grafted on to healthy ones at five-day intervals following inoculation showed that a minimum period of 20 days was

necessary for the inoculated plants to develop their maximum protective action. It was further shown that tomato plants belonging to varieties with little natural propensity for recovery from curly top [loc. cit.] could be afforded partial protection by grafting with recovered tobacco plants. Once established in the tomato plants, the protective influence persisted through several serial cuttings for over a year and was transmissible to other healthy tomato and tobacco plants. This appears to be the first record of the particular type of passive immunization under review.

Costa (A. S.) & Forster (R.). **Uma suspeita moiéstia de virus do Fumo (Nicotiana tabacum L.), semelhante a 'leaf curl' presente no Estado de São Paulo.** [A suspected virus disease of Tobacco (*Nicotiana tabacum* L.) resembling 'leaf curl' present in the State of São Paulo.]—*J. Agron., S. Paulo*, ii, 5, pp. 295–302, 9 figs., 1939. [English summary.]

During the period 1938–9 a disease of tobacco resembling leaf curl was observed to be present to the extent of 1 to 5 per cent. in plantings of the Kentucky variety in the Piracicaba district of São Paulo, Brazil. Other varieties affected include Goiano, Flor branca, Virginia, Amarelinho, and Creoulo de Bragança, besides *Nicotiana sylvestris*. The disorder assumes three forms, two of which are common and are designated as the 'rugose' and 'leaf roll' types, the former corresponding to Thung's 'common kroepoek' and the latter (in part) to his 'transparent' [*R.A.M.*, xi, p. 478]: no description is given of the third, apparently very rare type, hitherto observed on one plant only. Unlike leaf curl, the São Paulo disease was not found to be transmissible by grafting and no insect vector is known, so that its nature remains for the present obscure.

Trotter (A.). **Una interessante mutazione teratologica nel Tabacco 'Aja Soluk' affine al 'kroepoek' riscontrata nel Leccese.** [An interesting teratological mutation in 'Aja Soluk' Tobacco related to 'kroepoek' encountered in the province of Lecce.]—*Boll. tec. Tab.*, xxxvi, 4, pp. 193–202, 4 pl., 2 figs., 1939. [English summary.]

The author's attention was recently drawn to a foliar anomaly in the Aja Soluk tobacco variety first observed in the province of Lecce, Italy, by M. Donadoni in 1932 and shown by him to be transmitted by the seed. The enations and other peculiarities of the leaves closely resemble those of 'kroepoek' [see preceding abstract], but in the present instance the disorder is regarded as more likely to be due to an hereditary teratological mutation than to a virus.

Johnson (E. M.), Diachun (S.), & Valleau (W. D.). **Experimental production of blackfire on Tobacco.**—*Phytopathology*, xxx, 1, pp. 73–79, 3 figs., 1939.

Large, zonate lesions, closely resembling those occurring in natural late-season epidemics of tobacco 'blackfire' (the term applied to the concentric type of spot produced under humid conditions on the leaves of topped plants by *Bacterium tabacum* or *Bact. angulatum*) developed

both on the White Burley and dark varieties as a result of spraying the foliage in the field and greenhouse at the Kentucky Agricultural Experiment Station with suspensions of virulent isolates of the causal organisms. In both series of experiments the spots expanded during the night with the accumulation of dew on the leaves in the field and the formation of a water film, which did not, however, induce water-soaking [*R.A.M.*, xix, p. 123], by an artificial fog in the greenhouse. The wet, necrotic, advancing border thus formed turned dry and brown in the course of the day. Dead areas 3 to 4 in. in diameter were formed by the extension of individual spots and the coalescence of adjacent diseased areas. This is believed to be the first report of the experimental production of the zonate blackfire lesions by pure culture inoculations under controlled conditions.

McLean (Ruth) & Pinckard (J. A.). **Field studies on paradichlorobenzene in the control of Tobacco downy mildew.**—Abs. in *Phytopathology*, xxx, 1, pp. 16–17, 1940.

In further experiments on the value of para-dichlorobenzene vapour in the control of tobacco downy mildew [*Peronospora tabacina*: *R.A.M.*, xviii, p. 419; xix, p. 242], 3 to 4 lb. No. 6 size crystals were broadcast on the ordinary cotton cover in a given seed-bed of 100 sq. yds. following the appearance of the pathogen. A cotton fumigation cover of 64 warp and 64 woof per in. was drawn over the treated bed and left in position for 24 hours. On farm-operated seed-beds three nightly 12-hour treatments sufficed to eliminate the fungus at a temperature exceeding 6° to 8° C., while on warm nights one such application may be adequate, using wet or sealed fumigation covers. Treatments made nightly and on alternate nights with half the quantity of para-dichlorobenzene mentioned above were likewise effective, but seedling injury resulted from experiments with shorter day treatments.

Pinckard (J. A.) & McLean (Ruth). **A laboratory method for determining the fungicidal value of vapors and its application to para-dichlorobenzene in the control of Tobacco downy mildew.**—Abs. in *Phytopathology*, xxx, 1, p. 19, 1940.

Known concentrations of para-dichlorobenzene vapour, approximating to a precision of three parts per 1,000, were delivered to tobacco seedlings infected with downy mildew [*Peronospora tabacina*: see preceding abstract] in jars continuously or intermittently, beginning on the third day after inoculation, the sporangial cycle of the pathogen being six days. Sporangial production was suppressed without damage to the host by single and alternate 12-hour treatments, the former being effective at concentrations equal to saturation above 7° C. (0·02 volume per cent.) and the latter at 0° (0·01). Concentrations at or above 13° (0·04 volume per cent.) caused injury to the plants after 12 hours. The vapour induces modifications in the pathogen or host, or both, involving the destruction or inhibition of the former without appreciable harm to the latter. In order to exert a fungicidal effect, the vapour must be soluble in the cell plasma. This method, therefore, gives results that at best are merely indicative of the important tissue concentrations which depend on the partial pressures.

Clayton (E. E.) & Foster (H. H.). **Disease resistance in the genus Nicotiana.**—Abs. in *Phytopathology*, xxx, 1, p. 4, 1940.

Over 1,000 collections of tobacco (*Nicotiana tabacum*, n = 24) from all known areas of its range have been tested for their reactions to blue mould [downy mildew] (*Peronospora tabacina*), black root rot (*Thielaviopsis basicola*), wildfire (*Bacterium tabacum*), bacterial wilt (*Bacterium solanacearum*), and mosaic. Resistance was strongly developed in respect of *T. basicola* and mosaic, but only of a slight to moderate order in the case of the other diseases, being recessive and conditioned by multiple factors as regards *Bact. solanacearum* and *P. tabacina*. Among the more promising of about 30 other *N.* spp. studied from the disease resistance angle are *N. debneyi* (n = 24), apparently immune from *P. tabacina* and *T. basicola*, and resistant to *Bact. tabacum*; *N. glauca* (n = 12), immune from *T. basicola* and highly resistant to mosaic and *Bact. tabacum*; *N. repanda* (n = 24), characterized by vigorous resistance to *Bact. tabacum* and *T. basicola*; and Smith's allo-polyploid (*N. tabacum* × *N. glauca*, n = 36), resistant to *T. basicola*. A reserve of resistance approximating to immunity is thus available for all the diseases under investigation except bacterial wilt.

Ghimpu (V.). **Les maladies et les insectes nuisibles au Tabac en Roumanie.** [Diseases and insects harmful to Tobacco in Rumania.]—Reprinted from *Bul. Soc. Şti. agric., Bucureşti*, i (*1938–39*), 7 pp., 1939.

Losses caused to the tobacco crop in Rumania through diseases [*R.A.M.*, xvi, p. 344] and insect pests are estimated to amount to 100,000,000 lei annually [approximately £125,000]. Virus diseases are responsible for the greatest losses in the field. Common mosaic is very prevalent and was studied in Bessarabia fifty years ago. It generally appears in the vicinity of Bucarest towards the end of May. Yellow and aucuba mosaics are rare and unimportant. White mosaic occurs regularly and ring spot is most prevalent near villages. Spot necrosis (caused by two potato viruses) is fairly common, and was very troublesome in 1934 in the vicinity of potato plantings. Streak was recorded in 1935.

Bacterial diseases are very harmful in the seed-beds during April and in the field during June. The most important is *Bacterium tabacum*, which often causes losses up to 25 per cent., but by adopting phytosanitary methods this disease has been eliminated from the experimental field at Băneasa. *Bact. melleum* [ibid., xvi, p. 214], *Bact. angulatum*, and *Bact. solanacearum* also occur.

In the seed-beds *Pythium de Baryanum* and *Rhizoctonia* [*Corticium*] *solani* are the most dangerous fungal pathogens, infection being favoured by rainy or cloudy weather and excessive irrigation. *Phyllosticta nicotianae* frequently attacks field crops in June, but does not cause important damage. The mycelium overwinters in tobacco trash in the drying sheds. *Ascochyta nicotianae* appears in May when the temperature is between 12° and 27 °C. *Alternaria tenuis* and *A.* sp. occur frequently both in the seed-beds and the field. *Erysiphe cichoracearum* occurs in glasshouses and plantations where shade is excessive. Other fungi

found on tobacco include *Asterocystis radicis* [*Olpidium brassicae*: see above, p. 263], *Phytophthora nicotianae*, *Thielaviopsis basicola*, *Fusarium oxysporum* var. *nicotianae*, *Nigrospora oryzae* (causing a leaf spot), and *Helminthosporium turcicum* (on seedlings). *Aspergillus fumigatus* is included in a list of 15 moulds recorded during the curing process.

Of the non-parasitic troubles noted a female sex-linked variegation is said to occur frequently.

Goldin (M. I.). **A virus strain of mosaic disease of the aucuba-type in Tomato.**—*C.R. Acad. Sci. U.R.S.S.*, N.S., xxv, 7, pp. 630–632, 1 fig., 1939.

In the course of microscopic examination of the protein inclusions encountered in tissues of plants affected with tobacco mosaic, a method of diagnosis widely applied on one of the State vegetable farms near Moscow, the author met with a virus, designated strain A, which differed from the virus of ordinary tobacco mosaic. Seedling tomato plants infected by strain A developed strikingly deformed filiform leaves, yellow mosaic symptoms appearing after one to two months. The strain caused local necroses on leaves of *Nicotiana sylvestris*, but no mosaic, thus differing from ordinary tobacco mosaic and resembling the aucuba mosaic virus. Furthermore, tissues of tomato plants infected with strain A showed similar intercellular inclusions to those characteristic of the aucuba mosaic virus (namely, solid, brownish, granulated or oval inclusions, long needles, and, rarely, hexagonal crystals). The strain A retained all its properties when heated at 70° [C.] for 25 minutes. It is concluded that this variant is a type of aucuba mosaic not previously recorded in the U.S.S.R. The author also observed an 'enation' virus causing outgrowths from the lower surface of the leaf blades in tomato and tobacco plants, and producing peculiar modifications in the leaf veins, which appear to be inverted, so that the hairs are on the upper instead of on the lower side of the blade.

Alexander (L. J.). **A new strain of the Tomato leaf mold fungus Cladosporium fulvum.**—Abs. in *Phytopathology*, xxx, 1, p. 1, 1940.

Continuing his work [in Ohio] on the breeding of tomatoes for resistance to leaf mould (*Cladosporium fulvum*) [*R.A.M.*, xvii, p. 419], the writer reports that the new variety Globelle, formerly as resistant as one of its parents, *Lycopersicum pimpinellifolium*, developed a susceptible response to infection which was subsequently shown to be due to the appearance of a new physiologic race of the pathogen, also attacking *L. pimpinellifolium*. In cross-inoculation tests Globe and Globelle plants proved uniformly susceptible to spores of the fungus collected on the leaves of the latter variety, but when individuals of the two varieties were inoculated with spores from diseased Globe foliage procured from a distant site, Globelle was highly resistant and Globe susceptible.

Harrison (A. L.). **A method for testing resistance of Tomatoes to Fusarium wilt.**—*Phytopathology*, xxx, 1, pp. 86–87, 1 fig., 1940.

Thousands of young tomato plants were successfully inoculated in varietal reaction trials at the Texas Agricultural Experiment Station

in 1939 with the causal organism of wilt (*Fusarium bulbigenum* var. *lycopersici*) [*R.A.M.*, xix, p. 170] by the immersion of the roots for five to ten minutes in four- to seven-day-old liquid nutrient cultures, followed by immediate transplantation to flats or cold frames. Of the 1,200 seven-week-old seedlings inoculated on 24th February and showing the first symptoms of wilt on 15th March, only 33 lived long enough to produce any seed and none was free from vascular disoloration. By the 25th day after inoculation all the plants of the susceptible Gulf State Market variety had collapsed, while most of the resistant Louisiana Pink and Louisiana Dixie were still healthy, though many succumbed at a later stage. The wilt-resistance ratings obtained by this method were found on comparison to be of the same order as, but somewhat lower than, those secured under severe wilt conditions in the field, indicating superior selectivity as a feature of the root-immersion technique.

Miller (P. W.). **Nut diseases in the Pacific Northwest in 1939.**—*Plant Dis. Reptr*, xxiii, 20, pp. 334–337, 1939. [Mimeographed.]

Brief, popular notes are given on diseases of Persian [English] walnuts [*Juglans regia*] and filberts [*Corylus avellana*] in the north-western sections of the United States in 1939. Diseases of the former host included bacterial blight (*Phytomonas* [*Bacterium*] *juglandis*) [*R.A.M.*, xviii, p. 423], ring spot (*Ascochyta juglandis*) [ibid., xiv, p. 204], downy spot (*Microstroma juglandis*) [ibid., xvi, p. 642], and the non-parasitic leaf scorch [ibid., xv, p. 587], freckle spot, sun scald, and 'black line'. The last-named [cf. ibid., xii, p. 601], characterized by girdling of the bark at the graft union, killed a large number of 12- to 24-year-old trees in Oregon. The affected trees were English walnuts of the Vrooman Franquette variety on California black walnut rootstocks. The disorder has never been observed on Franquettes topworked or grafted on English walnut rootstocks.

The filbert diseases dealt with include blight due to a species of *Bacterium* [closely resembling *Bact. juglandis*: ibid., xviii, p. 424], mildew (*Phyllactinia corylea*) [ibid., xvi, p. 21], and the non-parasitic disorders leaf scald (which mostly affected orchards on shallow soils and was of considerable economic importance, as it caused appreciable decrease in functional leaf area and, in some cases, premature leaf fall), brown stain [ibid., xi, p. 683], 'blanks' (causing embryo abortion, and resulting, in 1939, in crop losses of 5 to 40, average about 15, per cent.) [cf. ibid., v, p. 118], sun scald, and drought injury.

Baxter (D. V.). **Some resupinate Polypores from the region of the Great Lakes. X.**—*Pap. Mich. Acad. Sci.*, xxiv, pp. 167–188, 7 pl., 1939.

Included in this critically annotated list of 13 resupinate Polypores from the Great Lakes region of the United States and Canada [*R.A.M.*, xvii, p. 635] are two new species [with Latin diagnoses], viz., *Polyporus tacamahacae*, isolated from balsam poplar (*Populus balsamifera*) in Alberta, and occurring also on *P. trichocarpa*, and *Polyporus illinoisensis*. *P. tacamahacae* is characterized by whitish to very pale green, somewhat glossy, annual fructifications, with a distinct whitish

margin, forming a skin-like sheet about 1·5 mm. thick over the bark; a white to cartridge-buff subiculum, up to 2 mm. thick; tubes 2 mm. long or up to 3·5 mm.; whitish or pale green mouths, 5 to 6 per mm., drying to cream or colonial buff or Verona brown; basidia 9 to 18 by 3 to 4 μ; spores 4 to 5·5 by 1 to 2 μ; and hyaline, extensively branched hyphae, 1 to 3 μ in diameter. The fungus makes rapid growth on malt agar, especially in the dark, and falls in the 'average temperature' and 'wide range' groups of the Polyporaceae. It was also found in the Northwest Territories (Canada), Idaho, Michigan, Nebraska, and New York.

P. illinoisensis, isolated from *Cephalanthus occidentalis*, in Michigan and Illinois, resembles *P. farlowii* except in its semi-resupinate habit, dark brown setae, 13 by 4 μ, and slightly smaller, yellow or light brown spores, 4 to 4·5 by 3 to 3·5 μ.

Baxter (D. V.) & Manis (W. E.). **Polyporus ellisianus (Murr.) Sacc. & Trott. and Polyporus anceps Pk. in culture: a study of isolates from widely separated forest regions.**—*Pap. Mich. Acad. Sci.*, xxiv, pp. 189–195, 3 pl., 1 fig., 1939.

The numerous variations in malt and water agar cultures of eight isolates of the fungi referred to in the relevant literature as *Polyporus ellisianus* [*R A.M.*, x, p. 571; xi, p. 615] and *P. anceps* [ibid., xii, p. 341; xviii, p. 4], causing severe decay of pine (*Pinus ponderosa*) in the south-western United States and prevalent on black spruce (*Picea glauca*) in the Northwest Territories, Canada, point to the existence of different races or strains within the species. On the other hand, the known morphological distinctions are not regarded as sufficient to separate the two species.

Spaulding (P.). **Spongy white rot of hardwoods (Fomes connatus (Weimann) Gillet).**—*Tree Pest Leafl. Soc. Amer. Foresters, New England Sect.*, 38, 4 pp., 3 figs., 1939.

This is a popular account of the fungus *Fomes connatus* [*R.A.M.*, xviii, p. 280] occurring on various forest, street, and ornamental trees (of which 21 are listed) in the United States, and the means of control.

Tyler (L. J.), Parker (K. G.), & Pope (S.). **Relation of wounds to infection of American Elm by Ceratostomella ulmi, and the occurrence of spores in rainwater.**—*Phytopathology*, xxx, 1, pp. 29–41, 1940.

In the course of four years' field observations in and near New York City the writers noted the frequent production of the coremia of *Ceratostomella ulmi* in more or less exposed sites, not only on diseased elms but on apparently uninfected trees in an enfeebled condition. The organs were detected, for instance, on the outer surface of the inner bark protruding into the space formed by the loosened and partly raised outer rough bark, in *Scolytus* beetle entrance holes and feeding wounds, and in the openings into leopard moth [*Zeuzera pyrina*] galleries. In laboratory experiments the spores of the fungus were easily dislodged from the fruiting structures by means of a water spray, but only to a limited extent, dependent on a variety of factors, by air

currents [*R.A.M.*, xvii, p. 143]. Rain water collected during the summer of 1937 and 1938 from 32 diseased field elms yielded *C. ulmi* in pure culture in nine cases.

The infection of potted American elms (*Ulmus americana*) readily followed the introduction of *C. ulmi* spores into fresh wounds extending into the root, trunk, and branch wood. Positive results also followed the application of inoculum to the freshly exposed but uninjured wood surface, while mild symptoms, unaccompanied by wilting, were sometimes obtained when spores were inserted in the leaf traces, in injured midribs, or in the succulent portions of newly formed or developing shoots. The application of spores to unwounded surfaces or to superficial cortical injuries, not involving the wood, gave negative results. The introduction of *C. ulmi* spores into the soil round wounded roots caused infection at any time from 2nd April to 3rd November, inclusive, the period of maximum invasion extending from 25th May to 1st September. Trees inoculated before the buds began to swell and up to the time the new shoots reached a length of 1 to 3 in. mostly contracted infection, but seldom or never in a severe form, whereas severe wilting, die-back, and fungal discoloration resulted from inoculation from 25th May to 1st or 15th July, when terminal shoot growth was completed. Inoculation during the period between the cessation of terminal growth and early September frequently induced considerable discoloration but little die-back. The high moisture conditions (85 to 98 per cent. relative humidity) of moist chambers were more conducive to infection in trees inoculated through wounds on aboveground parts than the comparatively dry atmosphere (40 to 80 per cent.) of a greenhouse with open ventilators, coremia being produced exclusively in the former environment.

Lepik (E.). **Estonia. The Elm disease in the country.**—*Int. Bull. Pl. Prot.*, xiv, 1, p. 2, 1940.

Ceratostomella ulmi, which probably made its first appearance in Estonia between 1930 and 1935, has now been observed in eleven districts throughout the country, causing extensive wilting.

Leach (R.). **Biological control and ecology of Armillaria mellea (Vahl) Fr.**—*Trans. Brit. mycol. Soc.*, xxiii, 4, pp. 320–329, 2 pl., 1939.

Further studies on the ecology of *Armillaria mellea* on tea in Nyasaland and its biological control by ring-barking [*R.A.M.*, xvi, p. 564] are described. As in other parts of tropical Africa, *A. mellea* develops rhizomorphs only sparsely, the longest found by the author being 18 in. long. Infection is caused largely by root contact, and the continual replacement of young tea bushes attacked by the fungus has proved to be the only successful method of treatment in young tea gardens. Affected bushes appear unthrifty for six months or a year before death. As a result of the carbohydrate depletion caused when the fungus completely girdles the tap-root of a tea bush, a few lateral roots below the girdled zone are generally invaded by *Rhizoctonia lamellifera*; where the dry-rotted tissues of such laterals meet tissues invaded by *A. mellea*, the latter forms a black zone line and makes no further progress.

Similarly, *A. mellea* on penetrating roots of *Parinarium mobola* invaded by unidentified fungi formed a zone line round the affected wound area.

In an experiment made to test the practical application of the antagonism between *A. mellea* and other fungi, woody prunings were left on top of the soil for one month and allowed to become infected with saprophytes, after which they were buried next to fresh woody prunings, *Gliricidia sepium* roots infected with *A. mellea* being placed in contact with both sets of prunings. After one month the fresh prunings had become heavily infected by *A. mellea*, whereas the dead ones were unaffected; this result was confirmed when the experiment was repeated in the laboratory. Planters should leave their heavier prunings above ground for at least a month if they do not wish to incur the expense of removing them.

Test-tube cultures of *A. mellea* on blocks of *P. mobola* root with bark adhering showed that numerous dark brown strands of xylostroma broke through the bark of sterilized healthy roots, whereas the xylostroma failed to rupture the bark of sterilized roots from trees ring-barked a year before. This reduction in xylostroma development sometimes occurs naturally in a lateral root of tea infected by *A. mellea*. It is thus apparent that ring-barking would reduce the infectivity of the roots of a tree attacked by *A. mellea* after ringing, since penetration of the strands of xylostroma through the bark and the development of rhizomorphs would be reduced.

To cause depletion of the roots as rapidly as possible by ring-barking, deciduous trees should be ringed just after breaking into leaf. Trees which die slowly after ring-barking should be felled one year after ringing. All sucker growth on the trunk below the ring and from the surface roots must be suppressed.

An experiment [which is described] made to ascertain the relative susceptibility to *A. mellea* of felled and standing indigenous trees showed that nearly every species of tree found in the tea districts of Nyasaland is a potential host of the fungus though the roots of a few species only are commonly associated with root rot of tea. The roots of most species normally localize infection but when severed the fungus travels in them freely. Other experimental evidence, besides supporting the view that control results from ring-barking, indicated that trees growing near dead stumps in forests may have many localized lesions of *A. mellea* dormant in the roots, in which the fungus may become active when the forest is felled for a plantation crop. It may spread from these localized lesions even though the roots of the original dead stumps may have been rotted by *A. mellea* too far to be capable of producing infection.

The rate at which roots die after the tree is felled is believed to be the factor controlling the distribution of *A. mellea* in cleared forests. Roots of quickly dying trees become invaded by saprophytes and consequently cannot be attacked by *A. mellea*. Such roots probably form a barrier in the soil, through which *A. mellea* is unable to spread should it approach along the moribund roots of the slowly dying trees. This may explain why root disease is so often found in small, isolated patches of tea planted on the site of a mixed forest. The species of tree most dangerous as sources of infection are those whose roots die very slowly after felling, such as *Afrormosia angolensis* and *P. mobola*, since

Armillaria mellea can spread unimpeded along a network of moribund but still susceptible roots.

HEPTING (G. H.). **A vascular wilt of the Mimosa tree (Albizzia julibrissin).**—*Circ. U.S. Dep. Agric.* 535, 10 pp., 3 figs., 1939.

Further investigations are reported into the highly destructive wilt disease of the mimosa tree (*Albizzia julibrissin*) [*R.A.M.*, xv, p. 758], widely grown in the southern United States as an ornamental. The disease was first observed in 1935 at Tryon, North Carolina, but is reported by local residents to have been present since 1930. It has since spread to many widely scattered localities in the south-east and has killed several thousand trees. A survey made in Tryon in 1938 showed the mortality of the street trees due to wilt to be about 70 per cent. Death of the tree usually occurs within a year from the first appearance of wilting, but has been known to take place in trees 15 to 20 ft. tall within a month. At the time of wilting a brown ring or partial ring of discoloured sapwood can be found in the trunk and later this extends to the branches. Isolations made from the discoloured sapwood of affected trees from seven localities yielded consistently a *Fusarium* of the *Elegans* section, which is named *F. perniciosum* n.sp.; an isolate from trees at Wisacky appeared slightly different, and it is left to further study to determine whether it is a morphological variant of *F. perniciosum* or a distinct species. Inoculations made with both forms were successful. *F. perniciosum* is described [with a Latin diagnosis] as follows: the mycelium is at first colourless, turning later rose-purple and magenta or darker; microconidia are formed abundantly in false heads, and are typically ovoid, unicellular, white to buff-pink in the mass; macroconidia are produced usually on sporodochia or sometimes on aerial mycelium, are uni- to tri-septate, curved, gradually attenuated towards both ends, typically triseptate, 23 to 32 by 3·9 to 4·9 μ; and the chlamydospores are terminal, intercalary, intraconidial or attached to conidia, globose to piriform, with a mean diameter of 7 μ.

Fruiting bodies of several species of *F.* were frequently found on bark of wilting or dead trees, but none belonged to the *Elegans* section, which includes all the species of *F.* known to cause wilt. It is believed that Voronikhin, who investigated a similar disease in Russia [loc. cit.], was dealing with one of these secondary species.

The disease has been observed on soils ranging from clay to sand, from acid to alkaline (P_H 4·5 to 7·8), and from elevations near sea-level to 2,200 ft., but the known infection areas do not appear to form a definite geographical pattern. The disease is probably soil-borne, and transportation of soil, either directly or attached to the roots of plants, from areas of known infection should be discouraged. Planting stock should be selected from definitely disease-free areas. No means are at present known to check the spread of the disease in areas where it has become established, and in such areas it would be best to replace the mimosa by other species. As a measure of precaution pruning and other wounds should be disinfected and covered with a serviceable coating, and tools employed on suspected trees sterilized before use on healthy mimosas.

KIMMEY (J. W.). **Time of growth of Cronartium ribicola cankers on Pinus monticola at Rhododendron, Oregon.**—*Phytopathology*, xxx, 1, pp. 80–85, 2 graphs, 1940.

The seasonal fluctuations in the growth rate of 117 blister rust (*Cronartium ribicola*) cankers on 19 western white pines (*Pinus monticola*) [*R.A.M.*, xviii, p. 72] were studied at an elevation of 1,650 ft., at Rhododendron, Oregon, from 1934 to 1937, inclusive. Two series of cankers were used, 52 on 12 trees from March 1934 to June 1935, and 65 on 7 from March 1936 to May 1937.

There were great differences in the seasonal growth periods of the individual cankers, and to a lesser extent between their two ends. Development was rapid from April to November and ceased for up to three months or even longer during the winter. About 90 per cent. of the annual increment was laid down between 1st April and 1st November, as against only 2·5 per cent. from December to February. A correlation was observed between the prevailing temperature and canker growth, rapid expansion being promoted, for instance, by the exceptionally warm spring of 1934, and a severe check to development following the abnormally cold weather in January of 1935 and 1937, and the unusually cool springs of the same years. The time of the rupture of the peridia on blister rust cankers and that of the breaking of buds on deciduous trees in the spring may be regarded as probable indicators of the commencement of canker growth acceleration, the corresponding period of retardation in the autumn synchronizing with the fall of the leaves in the autumn.

RIKER (A. J.) & KOUBA (T. F.). **White Pine selected in blister-rust areas.**—Abs. in *Phytopathology*, xxx, 1, p. 20, 1940.

Most of the small white pine [*Pinus strobus*] trees in unprotected areas of Wisconsin are stated to have been killed by the invasion of *Cronartium ribicola* [*R.A.M.*, xix, p. 247], but the survival of, say, one out of 300 to 500 trees in an apparently healthy condition for several years led to a search in 1938 and 1939 for cones from such resistant individuals for propagation. Four selected areas yielded 163 trees which had withstood natural infection by the rust for 15 to 20 years without evidence of canker formation. Recent surveys disclosed some 10,000 to 60,000 ft. of *Ribes* live stem per acre. Preparatory to exposure to natural and artificial infection at a suitable age, the cones from each of the seemingly resistant pines were planted in separate rows in the nursery and veneer grafts with scions from 40 parent trees successfully made in the spring of 1939.

CHILDS (T. W.). **Decay of slash on clear-cut areas in the Douglas Fir region.**—*J. For.*, xxxvii, 12, pp. 955–959, 1939.

The examination, from 1928 to 1931 and again in 1936–7, of logging debris on 135 representative slashings west of the Cascade Mountains in Oregon and Washington, indicated that fungal decay is too slow to facilitate fire control materially. The average branch volumes of Douglas fir (*Pseudotsuga taxifolia*) decayed after 16 to 20 years were 60 and 50 per cent. for small and large branches, respectively, the corresponding figures for western hemlock (*Tsuga heterophylla*) and Sitka spruce

(*Picea sitchensis*) after 11 to 15 years being 91 and 81 and 85 and 75 per cent., respectively. The fungi concerned in the rotting include *Lenzites sepiaria*, *Fomes pinicola*, *F. subroseus* [*R.A.M.*, xviii, p. 505], *Polystictus abietinus* [ibid., xviii, p. 562], *Ganoderma oregonense* [ibid., xi, p. 615], *F. applanatus* [*G. applanatum*], and *Schizophyllum commune* [ibid., xix, p. 175], while *P.* spp. (chiefly *P. cuneatus*) [ibid., viii, p. 541] are mainly responsible for damage to western red cedar (*Thuja plicata*). The heat- and drought-tolerant *L. sepiaria* causes more than one-third of the decay of sapwood, except in Douglas fir on unburned slashings in the spruce-hemlock type, while *F. pinicola* is the most important single cause of heartwood rotting, though *L. sepiaria* and *F. subroseus* are very prevalent in hemlock and Douglas fir heartwood, respectively. Sporophores are seldom found on slash less than three years old, and are most abundant from four to six or seven years after logging. Both *F. subroseus* and *F. pinicola* are capable of attacking living trees, but the sporophores of these fungi are rare in the region under observation on slashings old enough for the reproduction to have become susceptible.

Verrall (A. F.). **Relative importance and seasonal prevalence of wood-staining fungi in the United States.**—*Phytopathology*, xxix, 12, pp. 1031–1051, 1 fig., 2 graphs, 1939.

Staining of hardwood logs and timber in Louisiana, Mississippi, and Georgia was shown by intensive studies and inoculation experiments in 1937–8 to be principally due to *Endoconidiophora coerulescens* [*R.A.M.*, xiv, pp. 270, 729], *Ceratostomella pluriannulata* [ibid., xv, p. 69], *Diplodia natalensis* [ibid., xiv, p. 729], and *Graphium rigidum* [ibid., xix, p. 57], all of which occurred indiscriminately on red gum (*Liquidambar styraciflua*), yellow poplar (*Liriodendron tulipifera*), *Platanus occidentalis*, oaks, *Nyssa* sp., beech, *Magnolia*, and hickory, the first-named being perhaps the most susceptible. Pines (*Pinus palustris*, *P. taeda*, *P. caribaea*, and *P. echinata*) sustained the heaviest damage from *C. pilifera* [ibid., xviii, p. 488], *C. ips* [ibid., xviii, p. 772], *D. natalensis* [ibid., xvi, p. 219], and an apparently undescribed *D.* sp., possibly a variety of *D. megalospora* [ibid., xvi, p. 787]. It is characterized on malt agar at 28° to 30° C. by carbonaceous, inverted-clavate or globose, rostrate, ostiolate, smooth pycnidia, 202 to 386 by 151 to 269 μ; simple, hyaline conidiophores 20 to 32 by 2 μ, bearing conidia at first unicellular and hyaline but becoming golden-brown at maturity, with 0 to 3 septa but mostly uniseptate, granular, slightly clavate and tapering towards the base or truncate, 32·4 to 42 by 12 to 16 (which may be 37·3 by 13·7) μ. Fungi of minor importance isolated from hardwoods included *E. moniliformis* [ibid., xix, p. 57] (also from pine), a *Torula* allied to *T. ligniperda* [ibid., xii, p. 123], *Alternaria* spp. (also from pine), *Cladosporium* sp. (also from pine), *Helminthosporium geniculatum* (also from pine), two or more species of *Leptographium* (one also from pine), and *G.* spp., while pines yielded *Ceratostomella obscura* [ibid., xiv, p. 729], *C. pini* [ibid., xiv, p. 68 *et passim*], *C. exigua* Hedgc. (*Rep. Mo. bot. Gdn*, xvii, pp. 59–114, 1906), *C. multiannulata* [*R.A.M.*, xiv, p. 729], *C. pluriannulata*, *E. coerulescens*, *Pullularia pullulans* [ibid., xviii, p. 774], *Cadophora* spp., including *C. brunnescens* and *C. repens* [ibid., xiv, p. 729], and *C. rigidum* (unimportant on pines). The newly reported

D. sp. was absent from eastern Georgia, but otherwise there were no apparent geographical restrictions on the distribution of the staining fungi within the States embraced in the survey (which extended in part to Alabama and Florida).

D. natalensis was found to be most active during the hot summer months, though present to some degree as late as November; as its incidence fell, that of *Ceratostomella pilifera* rose, though in certain localities the latter organism was also prevalent in warm weather. *E. coerulescens* tended to undergo a diminution of vigour during the summer, but on the whole predominated, among the major hardwood-staining fungi, throughout the greater part of the year. There was a rough correlation between the seasonal fluctuations of the fungi under observation and the temperature relations for their growth. The frequency of *C. ips* is probably determined in a large measure by the distribution of the *Ips* beetles with which it is associated. Among the other fungi investigated the seasonal changes were not of great significance. The depressing influence of high temperatures on fruiting is thought to account for the falling-off of certain species during hot weather, while the virtual disappearance of *D. natalensis* throughout the cooler months may be attributable to the cessation of the production of inoculum on such common hosts of the fungus as cotton and sweet potato.

Report of Committee 17—wood preservation. Appendix D (4). Effect of preservative treatment by the use of creosote-petroleum, and zinc chloride and petroleum.—*Proc. Amer. Rly Engng Ass.*, xl, pp. 493–505, 1939.

Tables are presented showing the performance to date (January 1939) of about 1,000,000 hardwood and conifer sleepers in test tracks of the Northern Pacific, Reading, and Atchison, Topeka, and Santa Fé Railways treated with creosote-petroleum mixture (222,000), zinc chloride-petroleum (15,000), zinc chloride, creosote, and petroleum (16,000), and creosote alone (790,000), the last-named mostly at 5 lb. per cu. ft., the remainder at 7 lb. In the creosote- and creosote-petroleum-treated material (some of which had been on the tracks since the early years of the century), less than 5 per cent. of the failures were primarily due to decay, whereas about 65 per cent. of the failures in sleepers impregnated with zinc chloride resulted from this cause.

Robertson (W. A.). **Report of the Director of Forest Products Research for the year 1938.**—*Rep. For. Prod. Res. Bd, Lond., 1938*, pp. 3–84, 4 pl., 3 figs., 9 graphs, 1939.

The following are among the items of interest in this report [cf. *R.A.M.*, xviii, p. 75] apart from those already noticed from other sources. A new wood preservative (British Patent Application 3554/38, controlled by the Department of Scientific and Industrial Research) has been evolved [ibid., xviii, p. 830], the toxic constituent of which is mercuric chloride, a substance more toxic to wood-destroying fungi than any other inorganic compound commonly used as a wood preservative. Corrosion of metals by this preservative was so much reduced by the addition of sodium sulphite or sodium nitrite that the solution could

be used in ordinary steel equipment. As the mixture can be used at weak concentrations, its cost compares advantageously with that of other wood-preserving solutions.

Experimental evidence showed that wood-destroying fungi inducing brown rot, i.e., those attacking cellulose and carbohydrates only, cause the nutritive medium in which they are grown to become and remain extremely acid, whereas fungi producing white rot induce a temporary acidity, after which the P_H value of the medium returns to about its original figure.

The effect of the presence of rusting iron on the rate of decomposition of wood by fungi was ascertained to be a reduction in the amount of fungal decay, small amounts of soluble iron salts exercising a toxic effect on the fungi.

Trouble sometimes arises in the kiln-drying of oak from a yellow mould that grows over the boards. This is caused by a fungus of the *Penicillium divaricatum* group (syn. *Paecilomyces varioti* [ibid., xvii, p. 364] and *Eidamia catenulata* [ibid., xvi, p. 4]). Growing at temperatures up to 44°C., this fungus finds excellent conditions for its development in the early stages of the kiln-drying of oak planks. The development of the mould can, however, be checked by dipping the planks in a solution of one of the proprietary anti-stain substances of the chlorinated phenol type, though it was ascertained that mould growth was not completely inhibited by dipping in solutions containing up to 1·25 per cent. of the antiseptic. The superficial mould growth which may occur in a kiln on undipped planks may be checked by spraying the pile of timber with formaldehyde solution; this, however, involves using a respirator and does not prevent internal staining. A better method is to dip the planks in the antiseptic solutions immediately they have been sawn.

Data are tabulated showing that the extent to which timber has been decayed by fungi exerts a remarkable influence on the rate of development of the death-watch beetle (*Xestobium rufovillosum*).

During 1938 a number of inquiries were received concerning 'dote' or incipient decay caused in Douglas fir by *Trametes serialis* [ibid., xviii, p. 76]; the condition develops only under unsuitable storage conditions.

Ohl (F.). **Konservierungsmittel für die Papier-, Karton- und Pappenindustrie.** [Preservatives for the paper, carton, and cardboard industry.]—*Wbl. Papierfabr.*, lxx, 41, pp. 839–841, 1939.

After showing that none of the many commercial paper and cardboard preservatives on the German market is universally applicable, the writer discusses a number of such preparations and emphasizes the different points to be considered in making a selection for specific purposes.

Chlorothymol is soluble in water in the ratio of 3 : 10,000, and is mostly used as a solution with sodium lye or in alcohol. Its phenol coefficients are remarkably high, namely, 110 and 343 in soap and aqueous solutions, respectively. This compound and chlorisothymol (the latter a trade product supplied in the 'pure' and lye forms) may be utilized for a variety of objects. Chloro-cresol and -phenol salts are

also widely used, generally under registered trade names. 'Raschit', for instance, a colourless crystalline substance, represents para-chlorometacresol, the sodium salt of which is known as 'Raschit W'. Another cresol compound, the complex para-chlorometacresol-alkali, is a yellowish-white powder known as 'grotan'. The various 'preventols' used in paper and cardboard factories are also cresol and phenol products. Other paper preservatives include 'amicrol', 'solbrol', toluolsulphochloramide salts, halogen alkyl-phenols, chloroxylenol, hexylresorcin, 'nipagin' (the methyl ester of para-oxybenzoic acid) [*R.A.M.*, xii, p. 524], and ortho-phenylphenolsodium (sodium ortho-oxydiphenyl); the three last-named are of special interest, hexylresorcin and 'nipagin' on account of their absence of odour and non-toxicity to man, and ortho-phenylphenolsodium by reason of its extremely powerful disinfectant action (20 times higher than that of phenol), enabling it to be used at the low concentration of 0·5 to 1 per cent. of the dry weight of the material to be preserved, while even $\frac{1}{16}$ per cent. is reported by certain glue manufacturers to afford adequate protection. Para-chlorometacresol should be used at an average rate of 0·05 per cent. for plant glues, e.g., starch products, and at 0·2 to 0·25 per cent. for those of animal origin and casein emulsions. The usual rate of application for para-chlorometacresol-alkali is 0·05 to 0·2 per cent. of the dry weight of the material to be preserved, costing about 0·3 to 1 pfennig per kg.

A number of well-known disinfectants are unsuitable for use as factory preservatives, some on account of their poisonous properties, and others because of their liability to injure the goods thus treated. A case is cited in this connexion of the discoloration of dyed rayon hose packed in cartons prepared with formaldehyde.

The author draws attention to the importance of determining the particular fungi and bacteria to be combated in specific instances, so that manufacturers of disinfectants may supply the preparations best adapted for the purpose required.

BOTTOMLEY (A[VERIL] M.). **Intensive Mushroom-growing for the amateur.**—*Bull. Dep. Agric. S. Afr.* 210, pp. 5–32, 12 figs., 1939. 6d.

The author gives a semi-popular account of the cultivation, marketing, pest and disease control, and cooking of mushrooms (*Psalliota* spp.) in South Africa. The information on fungal diseases of the crop has already been noticed from another source [*R.A.M.*, xix, p. 190].

MAYER (K.). **Die Kräuselkrankheit der Futter- und Zuckerrüben.** [Crinkle disease of Fodder and Sugar Beets.]—*Dtsch. Zuckerindustr.*, lxv, 1, pp. 53–56, 1 fig., 3 graphs, 1940.

This is a survey of the available information on fodder and sugar beet crinkle in Germany [*R.A.M.*, xviii, p. 107] with special reference to the life-history of the insect vector, *Piesma quadratum*, the relationship of environmental conditions to its activities in the spread of infection, and its control by means of traps. Near relatives of *P. quadratum* infesting both beets and wild Chenopodiaceae (the latter being preferred) are *P. maculatum* and *P. capitatum* and its vars. *brachypterum* and *macropterum*.

Greis (H.). **Macrosporium cladosporioides, ein Erreger des Wurzelbrandes an der Zuckerrübe.** [*Macrosporium cladosporioides*, an agent of root rot of Sugar Beet.]—*Phytopath. Z.*, xii, 4, pp. 360–365, 2 figs., 2 graphs, 1939.

Macrosporium cladosporioides, hitherto known only as a saprophyte of beets, was observed in 1938 at the Kleinwanzleben (Germany) Research Institute, to be the joint agent, with *Pythium de Baryanum* and *Alternaria tenuis* [*R.A.M.*, xvii, pp. 368, 428] of a typical damping-off of sugar beets, involving the blackening and collapse of the young seedlings, the hypocotyledons of which were permeated and enveloped by a black mycelium.

M. cladosporioides produces two distinct types of conidia, one broadly ovate, with two to six transverse septa, occasionally uniseptate, and a few longitudinal, often only one, giving rise to confusion with *Cladosporium*, and the other clavate. The latter is frequently described as possessed of a smooth membrane, in contrast to the finely granular covering of the ovate conidia, but in the present observations some of the clavate conidia were definitely granular. The shape and size of the conidia are too variable to allow of the application of these characters for purposes of determination.

Positive results (up to 100 per cent. infection and collapse) were obtained in inoculation experiments in which sterilized seed-clusters were dipped in spore suspensions or painted with spores from pure cultures and subsequently maintained in a very damp atmosphere (80 to 90 per cent. relative humidity, or 50 to 70 per cent. for material allowed to germinate in the thermostat prior to planting out), either in Petri dishes at 20° C. or in dishes containing sterilized soil covered with bell-jars.

Good control was obtained by seed treatment with germisan or ceresan (short liquid process, 2 per cent. at 1·5 l. per 50 kg., or 30 minutes' immersion in 0·1 or 0·4 per cent., followed by six hours' covering), as well as by dusting with germisan at the rate of 350 gm. per 50 kg.

Roland (G.). **Essais de désinfection des graines de Betteraves, effectués en 1938.** [Disinfection experiments on Beet seed conducted in 1938.]—*Publ. Inst. belge Amélior. Better.*, vii, 5, pp. 543–547, 1939. [Dutch, German, and English summaries.]

In experiments conducted in 1938 at the Wageningen (Holland) Mycological Laboratory U.T. 685 dust (8 gm. per 1,000 gm. beet seed-clusters) and ceresan and germisan solutions (0·5 per cent.) were equally effective in the control of *Phoma betae* [*R.A.M.*, xix, p. 186], but the first-named has the advantage of greater facility of manipulation. The average increase in the incidence of germination as a result of the treatments was 40 per cent., the figures in both sterilized and unsterilized soils being comparable.

Goidànich (G.). **Il marciume dell' Insalata causato da 'Sclerotinia minoré' Jagg.** [The Lettuce rot caused by *Sclerotinia minor* Jagg.] —*Boll. Staz. Pat. veg. Roma*, N.S., xix 3, pp. 293–334, 2 pl., 13 figs., 1 graph, 1939.

Early in 1939 lettuces and endives growing in the vicinity of Rome

were killed off in large numbers when approaching commercial maturity by a rot due to *Sclerotinia minor* [*R.A.M.*, xvii, p. 433], not previously recorded on lettuce in Italy. In culture, the fungus formed irregularly round, erumpent, black sclerotia, 660 to 1050 μ in diameter. Microconidia, 3 to 3·6 μ in diameter and with a large central vacuole, were produced at the extremities of the hyphae or on short lateral branches. No apothecia were observed in nature or in culture, and from its morphological and cultural characters [which are fully described] the organism would appear to belong to Chivers's strain 1 [cf. ibid., viii, p. 607]. The optimum, minimum, and maximum growth temperatures were, respectively, about 22°, 3° to 5°, and about 35° C., while the fungus survived freezing and temperatures of over 35°. Experimental inoculations of healthy, wounded and unwounded cos lettuce, cabbage lettuce, wild and cultivated endive, and sunflower gave characteristic rotting, death supervening in a few days. Control is recommended by soil sterilization.

[A condensed account of this work appears in *R.C. Accad. Italia*, Ser. VII, i, 1, pp. 70–73, 1939.]

Service and regulatory announcements July–September, 1939.—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 140, pp. 115–117, 1939.

Summaries are given of recent revisions of the plant quarantine import restrictions prevailing in Cuba, Jamaica, Sierra Leone, Mexico, the Argentine, Turkey, Bermuda, Italy, Australia, Colombia, Kenya, and Paraguay.

Legislative and administrative measures.—*Int. Bull. Pl. Prot.*, xiv, 1, pp. 7, 11, 1940.

Germany. A Notification of 14th August, 1939, admits the following exceptions to the Decree of 8th October, 1937, relative to the control of potato wart disease (*Synchytrium endobioticum*) [*R.A.M.*, xvii, p. 551]. The non-resistant Erstling [Duke of York] may still be grown in 1941 in recognized centres for the production of very early crops, provided that the area covered by this variety does not exceed 35 per cent. of the total allotted for early potato cultivation, the remainder to be assigned to resistant sorts such as Primula, Frühmölle, Frühbote, Früheste Delikatess, or Sieglinde.

Mauritius. Proclamation No. 21 of 24th August, 1939, having declared all citrus trees growing on the Island of Rodrigues to be infected by *Pseudomonas citri*, the Director of Agriculture or any deputy authorized by him may at any time inspect the citrus-growing areas and order the destruction, removal, or other treatment of diseased or suspected plants.

Service and regulatory announcements July–September, 1939. Announcements relating to Woodgate rust quarantine (No. 65).—*S.R.A., B.E.P.Q., U.S. Dep. Agric.*, 140, pp. 111–112, 1939.

Notice is given of the revocation, effective as from 31st July, 1939, of the Woodgate rust [*Peridermium* sp.] quarantine, imposed in 1928, which prohibited the inter-State shipping of Scots pine [*Pinus sylvestris*] and other hard species from a regulated area in the north of New York State [*R.A.M.*, viii, p. 272].